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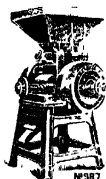
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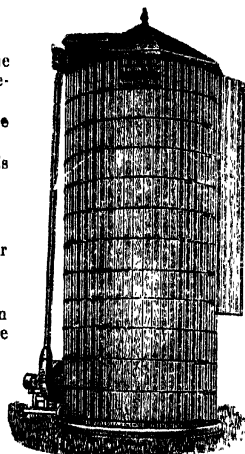
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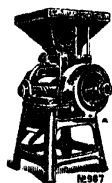
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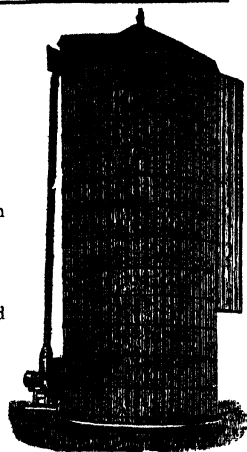
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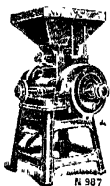
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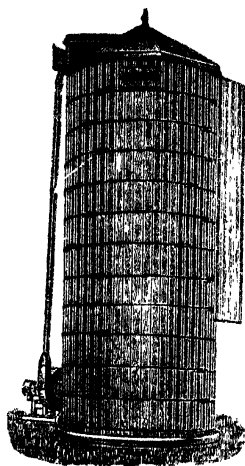
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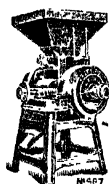
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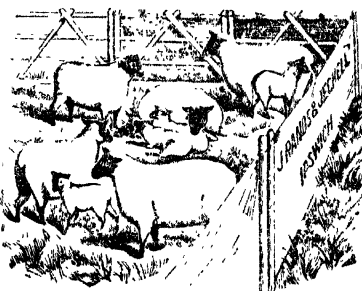
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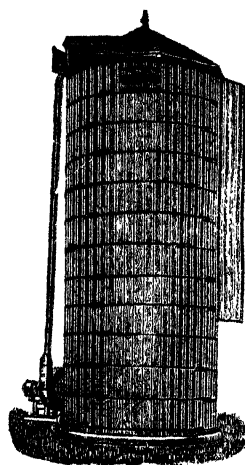
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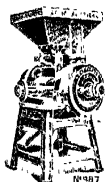
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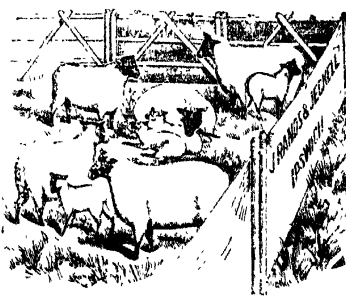
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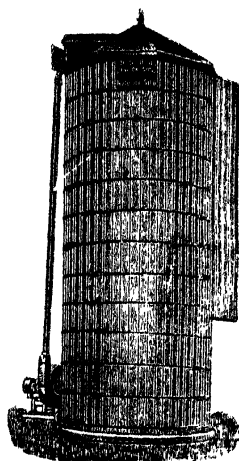
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THE JOURNAL OF THE BOARD OF AGRICULTURE

Vol. XXVI. No. 1.

APRIL, 1919.

EDITORIAL NOTES.

THE very considerable increase in the production of straw, owing to the much extended area under corn crops, has given large numbers of farmers cause for serious reflection as to the best means of using or disposing of their surplus. The obvious means in normal times would have been to stock more heavily, to produce more meat or more dung—but the recent great shortage of feeding stuffs has prevented most farmers from using all their straw in this manner. Unless, therefore, some outlet is found there must be a considerable surplus for use next winter. The Board have had the matter under investigation for two or three years past, and three possible methods of utilising straw have received attention: (1) Industrial uses of straw; (2) Enhancement of the feeding value of straw; and (3) Conversion of straw into manure without the aid of the animal. These questions are dealt with in the article on p. 4, and the conclusion is that farmers should not contemplate the sale of straw off the farm until they have exhausted the possibilities of using it to reduce the food bill and increase the production of manure for use on the arable acreage.

* * * * *

IN recent years a great trouble on many sheep farms has been the disease known as Louping-ill—a disease of a seasonal character, which for long appeared to baffle investigators who endeavoured to determine the cause, owing to apparent confusion in relation to diseases having one or more similar symptoms and to divergent opinions as to origin. An investigation of Louping-ill was undertaken some years ago by Sir Stewart Stockman, Chief Veterinary Officer to the Board, and in this issue of the *Journal* (p. 24) he contributes in a more or less popular form an account of the more important conclusions arrived at. The chief of these appear to be that no specific cure is known; that it may eventually be possible to resort to preventive inoculation and immunise breeding stock; and

that *eradication* depends on freeing the pastures from the ticks responsible for introducing the disease to the sheep—and this involves such methods as starving the ticks, dipping the sheep, etc. These questions are dealt with separately in the article by Sir Stewart Stockman.

* * * * *

FARMERS have anxiously awaited information as to the prices the Government were prepared to guarantee for the 1919 grain crops. A notice was issued to the Press

**Prices for 1919
Grain Crops.**

at the beginning of April to the effect that the prices guaranteed by the Government for the 1919 crops are 75s. 6d. per qr. of 504 lb. in the case of *wheat*; 68s. 10½d. per qr. of 448 lb. of *barley*; and 47s. 6d. per qr. of 336 lb. of *oats*. The guarantee applies to the normal sales and not to the produce consumed on the farm; the payments to growers will be the difference between "average prices" and the guaranteed prices, on the basis of yields per acre of 4 qr. of wheat, 4 qr. of barley, and 5 qr. of oats respectively; and the proportion normally sold will be taken as four-fifths in the case of barley and two-thirds in the case of oats. The full statement is given at p. 97. It was stated in the House of Commons on the 7th inst. by the Parliamentary Secretary to the Board that farmers who grew rye for the 1919 harvest at the request of the Board or the Ministry of Food would be brought under the terms of the guarantee price, but that the method of carrying out the guarantee had not yet been decided upon.

* * * * *

THERE is at the present time a great need for the extension of cheese-making which shows every prospect of being profitable,

**Whey for Calf
Rearing.**

and the Board have endeavoured during the past year or two to demonstrate in a number of centres the possibilities of co-operative cheese-making for farmers, and have arranged for instruction through travelling cheese schools. The chief objection of farmers in stock-raising districts to taking up cheese-making, is that they say they must have either whole milk or separated milk for their calves. The development of cheese-making is, therefore, held up until farmers can find a substitute for their calves. The substitute is at hand—in the cheese room—in the shape of whey. Most farmers may be unaware how they can use it with advantage for calf-rearing. About a year ago the Board arranged for trials to be made, and it has been found that by using a mixture of concentrated and highly-digestible foods the

difference in composition between milk and whey can be made good. Farmers are, therefore, now able to convert their milk into cheese without fearing that their calves will suffer severely, for they can rear them satisfactorily on whey and such substitutes as those mentioned. An account of the trials on rearing calves on whey and meals is given at p. 39.

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UP to the end of March a small publication known as "Weekly Notes" was prepared and issued by the Joint Committee of the Board and the Ministry of Food, who were responsible for 35 weekly issues. **Weekly Notes for Farmers.** Owing to the cessation of hostilities it has been decided that the existence of the Joint Committee is no longer necessary, and they accordingly concluded their work on 31st March. Certain of their activities will 'be continued by the Board, and the "Weekly Notes" will, for the present, be published each Thursday.

The object of "Weekly Notes" is to bring before farmers as early as possible information of immediate interest or importance, and to state in simple language the exact position in regard to matters which may present difficulties. Farmers are invited to communicate with the Board in respect of any point which they think might be elucidated in this publication.

Any newspaper, farmer, land owner, or land agent can obtain "Weekly Notes for Farmers" regularly (free and post free) by sending a request for its despatch, to *The Secretary, Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1*, writing "Weekly Notes" in the top left-hand corner of the envelope or post card of application. Communications to the Board need not be stamped.

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THE Board have in preparation a series of free Guides for Small Holders, prepared with the object of assisting men in the Forces who are considering the possibility of settling on the land after demobilisation. **Guides for Small Holders.** Although primarily intended for service men, the guides are available for the general public. The first of the guides (No. 1.—*Pig-keeping for Small Holders*) has already been issued, and copies can be obtained, price 2d. post free on application to *The Secretary, Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1*. Other guides to be issued shortly deal with *The Small Holder's Horse, Farm Crops, Soils and Manures, Co-operation for the Small Holder, Market Garden Crops, Fruit Growing on the Small Holding, Dairying, etc.*

REPORT ON THE WAGES AND CONDITIONS OF EMPLOYMENT IN AGRICULTURE.

THE Report* which has just been issued by the Board of Agriculture and Fisheries on the Wages and Conditions of Employment in Agriculture brings the long list of inquiries into the economic position of the agricultural labourer in England up to date. It follows for the most part the familiar lines of all such inquiries, but it has a special value and interest of its own, which distinguishes it from all those which have gone before, inasmuch as it relates to a period when a change is taking place in the economic state of the farm worker which is without parallel since the agricultural revolution of the Fourteenth Century. The drain of labour to the army and to other industrial employments which had been going on steadily for many years past was increased and intensified out of all comparison by the influence of the great War. New conditions, however, are now being introduced, which will, no doubt, profoundly modify not only the relations of employers to employed, but also the whole occupation of agriculture, including the ownership of land, the methods of cultivation, and the bearing which the use of that part of the soil of this country which is or can be devoted to the production of agricultural crops has to other vital industries, and to the welfare of the nation as a whole.

The Report, which has been drawn up by Mr. Geoffrey Drage, who was appointed Director of Investigations by the Board in October, 1917, aims at describing the state of English agriculture immediately before the outbreak of hostilities, and the changes which took place as the War progressed till the armistice relieved the situation. The Board were fortunate in being able to secure, for the collection of evidence, a staff of investigators whose untiring zeal and energy in carrying out their arduous duties were evidence of the public spirit with which they undertook their task. The record should be of great value, therefore, not only for historical and economic students but also for those whose duty it will be to deal with the problems of rural England in the immediate future as statesmen or administrators.

The Report is divided into two main parts, the first and longest dealing with conditions in England, the second dealing

* Vol. I., General Report (Cd. 24, 1919). Vol. II., Reports of Investigators (Cd. 25, 1919).

with Wales. The part relating to England is divided into six sections : (1) A Survey of Farming ; (2) The Supply of Labour and its Quality ; (3) The Conditions of Labour ; (4) Wages and Earnings ; (5) Cottage Accommodation and Rents ; (6) Relations of Employers and Employed, Gardens, Allotments, Small Holdings, etc.

PART I.—ENGLAND.

Section (1).—The Survey of Farming.—This section traces briefly the changes which came over English agriculture during the latter half of the Nineteenth Century, and shows how agriculture has become specialised in different counties according to the character of the soil. Large farms predominate where the land is suitable for arable cultivation, or where the fattening of cattle or rearing of sheep are important industries. Where stock farming or market gardening is carried on however the number of small holdings increases. The number of persons employed per 1,000 acres, however, is dependent on other causes, and the average ranges from 62 where the soil is predominately arable, and 42 where the soil is " arable with sheep nearly equal to the average for all England," to 35 where sheep rearing and feeding and cattle feeding are the common industries. The relative importance of cattle feeding, stock rearing and sheep rearing and feeding in different counties in England is discussed and tables are given showing three categories into which each county falls, according as the number of animals borne per 1,000 acres is above or below the third class, which is practically the normal. The influence which these styles of farming have on the conditions of persons employed is very great, and the Report shows that the hours, duties and status of the different workers vary widely with the character of the industry. These conditions are materially altered in those districts where market gardening, fruit growing and forestry prevail, and to a certain extent in those parts where seeds are grown, the labour needed for this industry being from four to five times that needed for ordinary agriculture, while wages are 10 to 20 per cent. higher. The effect of other rural industries, and the competition of those trades which are carried on in towns is examined, and it is interesting to observe that the farm-labouring population of Glamorgan is in all probability overwhelmingly English, all the Welshmen having gone to the collieries. Many of the Englishmen, moreover, who go to Wales to work at the collieries, iron works or docks, do not find life and work there as pleasant as they expected, and are glad to return to work on the land for lower wages.

Section (2).—The Supply of Labour and its Quality.—This section deals more with the actual changes wrought by the War than does the former section, and describes how severely some kinds of agriculture, such as fruit growing, and more especially osier growing, hop growing and nursery gardening, were injured by the short supply of labour and the inferior quality of the substitute during that time. Some of the workers in these occupations obtained a high degree of skill, with a proportionate reward, and their places cannot be filled by inexperienced newcomers. Market gardening, however, has suffered less than any other form of agriculture, owing to the numbers of small holders engaged in it, many of whom got exemption from military service for at least one man of the family, while the aid of women has been extensively given and with great success. The relative merits of substitute labour are examined with a refreshing candour, and it is difficult to say from the evidence quoted which is more noteworthy, the patriotic zeal and courage of vast numbers of the community who had never been employed in such work before, in undertaking and in all weathers tasks often wearisome and strange, or the good nature of the farmers who put up with their inefficiency and were willing to teach those who cared to learn. But the most interesting part of this section is that in which Mr. Drage discusses the relative efficiency of labourers in different parts of England. This is divided under the following heads: (1) muscular fitness; (2) mental alertness; (3) manual dexterity; (4) knowledge and experience of the materials with which he has to work; and (5) willingness to work. The difficulty of arriving at any standard is obvious and makes any comparison a matter more or less of opinion, a test which is of little value, since nearly every farmer is accustomed to decry the efficiency of the younger men as compared with that of the older ones, forgetting that he said the same thing 25 years ago when the men he is now praising for their skill were young. When a comparison is made by statistical method, however, it is found that the land and stock-managing capacity of each man employed in agriculture have risen considerably between 1871 and 1911, for against the decline of less than one acre of arable land per "man unit" there is to be set an increase of $7\frac{1}{2}$ acres of permanent and rotation grass and a considerable increase in live stock, especially cattle. As a large proportion of the increase in the total number of stock is due to an increase in milch cattle, which require a considerable amount of attention, the increase is important. The improvement is not due solely to

the labourer, and the improved skill of the farmer has undoubtedly contributed not a little to the result, but it seems clear that, taking the country as a whole, the skill and productive capacity of the agriculturist are greater now than was the case in 1871 at the end of the period which has been called "the golden age of English agriculture."

Section (3).—Conditions of Labour.—The skill and efficiency of the agricultural labourer, however, depend to some extent on the conditions of his employment. In most occupations division of labour tends to increase efficiency, but agriculture does not invariably follow the same lines as urban industries. Agricultural labour may be normally divided into two classes—(a) those who are engaged in the charge of animals, and (b) those who are not. Even this distinction, however, does not always hold good. In the eastern parts of England where arable farming prevails, or in Northumberland where farms as a rule are large, labour is specialised. The shepherd, the horseman, the stockman and the ploughman have their distinct duties and their social grades, and each is skilled in his own vocation. The labourers, the casual labourers, and the women and boys do the general work, though in harvest, perhaps, all hands will be engaged on the necessary tasks. But in the West, and where farms are smaller and fewer men are employed, all these distinctions disappear. The farm labourer is expected to turn his hand to any work that may require to be done. No indication appears to be given in the Report as to the relative efficiency of either system, but it is noteworthy that the War has contributed very largely to the breakdown of the employment of specialised labour, and in the past few years labourers have been required to do whatever work was needed. Where the other system was found, its chief effect appears to be on the condition of the animals of the farm, since those who have sole charge of them generally look after them better.

Conditions of employment vary in other ways. Where men are engaged by the year and "live in" they are better fed and, as a rule, better housed than where they "find themselves"; but "living in" is not always popular with either employers or workers, since it generally means longer hours and Sunday work for the men, and extra household work and loss of privacy for the family of the employer. As there is a constant tendency to reduce the hours of labour and to give greater freedom to the workers out of hours, the old custom of "living in" may undergo profound modifications in the near future. Agricultural

labourers can, as a rule, be sure of employment, and the bad practice of losing time when weather conditions make outdoor work unsuitable is disappearing, though it still lingers in farms on very heavy land. An allowance is even made in many places for "walking time," to enable men who live at a distance from their work to get pay for time spent in coming and going. Agricultural labourers' hours are of necessity long, especially in the milking business and among horsemen, while shepherds are obliged to be in constant attendance at certain seasons; but except where the nature of the occupation requires it the tendency is for hours of labour to shorten, except in harvest time, when everything is regulated by the weather and the crop. The hay in Westmorland is often carried up to 11 o'clock at night. The action of the Wages Board in fixing rates of wages will, no doubt, tend towards the standardisation of hours of labour. The Board do not fix the hours of work, but in order to fix a rate of wages it is obviously necessary to do so with reference to the period of time to which they refer, and there will, in course of time, arise a custom which is often stronger than law, which will fix the number of hours during which a man will be expected to get through the usual farm operations except in certain exceptional periods.

Section (4).—Wages and Earnings.—A large portion of the earnings of the agricultural labourer, including even the cash wages, is, or was at the time of the investigation, regulated chiefly by local custom and individual bargaining with an employer. Wages often differ, therefore, with the character of the workman or the employer, and exhibit every kind of variety. A rise in wages, for instance, often proceeds from farm to farm. One investigator writes: "The wages of farm labourers vary to such an extraordinary extent throughout the country that any estimate that can be supplied must necessarily be only of a very general character. The wages paid in a given district where conditions appear similar vary from one farm to another, and even on the same farm may be found men of apparently similar age and bodily strength doing similar work but receiving wages differing according to their skill. In one instance noted, one man received 3s. per week more than another man engaged on the same work. The farmer apparently makes the best bargain he can with his different employees, and it frequently happens that the latter do not know that any differentiation is made. If a labourer is a particularly good man the farmer will gladly increase his wage 5s. or 6s. a week rather than lose his services. The farmers also appear to have

only vague ideas as to the wages paid by their neighbours, and the majority when interviewed were unable to give any assurance that the wages paid by them to their men could be taken as being generally applicable throughout the district." Tables of rates of wages, therefore, can only be given in general terms. The Report, however, gives for the classes of shepherds, cattlemen, horsemen and ordinary labourers tables showing the prevailing summer and winter rates of cash wages in each county in England in 1914 and in 1917, together with the winter rates for 1918. The table shows that a certain readjustment of the distribution of wages has taken place since the last inquiry in 1907. The Northern counties and those having mining and manufacturing centres still pay the highest wages, but those counties in which the lowest wages were paid 12 years ago show considerable rises. It used to be accepted as an agricultural maxim that the lowest wages were paid in the arable counties. The influence of the War, however, the increased importance of arable farming, and the high prices of corn, have entirely destroyed the principle as applied to existing agricultural wages. If the cash wages of horsemen in 6 counties where pasture predominates are averaged and compared with the average of those paid for similar labour in 7 counties mainly devoted to arable, it will be found that the greatest increases are in the latter counties. Taking 100 as the index number of the wages paid in 1900 the figure for 1918 is 172 for the pasture counties and 189 for the arable counties. The figures for the price of wheat, barley and oats, taking 100 as the index number for 1900, rose in 1917 to 283, 261 and 285 respectively. A further comparison between the rise in wages between 1914 and 1918 in the counties where large farms are the rule with those where small farms predominate shows that the increase is greatest in the counties with large farms, though the small holding counties coincide to some extent with mining areas or districts with large towns. It might have been expected that piece-work would have become more usual as a result of this rise in day rates, but most of the investigators report that piece-work has grown steadily unpopular, especially since the War, and except in a few operations, such as hedge laying and hoeing, it is now only prevalent to any extent in the Eastern and South-Eastern Counties, especially Kent, where it can be done almost all the year round in the market-garden areas, and in the fruit and hop-growing districts of Hereford and its neighbourhood. Many reasons are given for this, but they amount in the long run to a disinclination on

the part of the men to take piece-work now that day rates have risen, the lack of skilled labour owing to the War, and the great difficulty in calculating the proper remuneration for the work. The investigator of Shropshire elucidates the last difficulty in the following words: "The tasks that are performed in piece-work vary immensely even in the same farm—even in the same field—under the varying conditions of wet or dry seasons. It must always be a matter of bargain between the farmer and the labourer, and the latter is guided in the price as to the length of time it will take him to do his work. Hoeing, for example, will take very much longer where the crop has been planted very close and the soil is very heavy than it will where the crop is thin and the soil light. Suppose a field of roots is to be hoed at so much an acre. If the rows were 18 in. apart, it is obvious that it will be a much greater labour to hoe an acre than it would be if the rows were 24 in. apart, and, therefore, that a higher rate would have to be charged. Similar reasoning applies in the case of turnip pulling. Even hedging varies with the nature of the fence you have to repair; the larger and rougher the fence has become the slower and more troublesome will be the job of putting it right. Fruit picking must depend on the state of the crop; it is obvious if the crop be very plentiful and the fruit large and well grown, the picker can fill his measure more rapidly than he can if the crop is thin and the fruit small and badly grown, so in the former case the rate of picking will be much lower than in the latter."

Although, however, cash wages form a considerable and in most cases the main part of a labourer's remuneration, allowances in cash and in kind continue to be given and vary much in value and extent. They are too numerous to be described in detail here. *

Section (5).—Cottage Accommodation and Rents.—The most important of the allowances, and one which affects not merely the agricultural labourer himself but also his family, is the cottage accommodation which is available for those workers who do not live in. As is well known it has long been customary in many districts to provide cottages for some of the more important employees, such as the shepherd and other men in charge of cattle, while even the other labourers often rent cottages from farmers at rates below their economic value. The effect of this system, which is universally admitted to be undesirable and in many respects unsound, has been to prevent the building of new cottages, and in this way to continue the use of many old ones, which should long ago have been con-

demned and pulled down. Although the evil is admitted the remedy is not obvious, and though Mr. Drage gives an account of the suggestions that have been made from time to time by different reformers, it is clear that he is not satisfied with any of them and sees difficulties in every proposal. This is especially the case as regards the legal liability which it has been advocated should attach to the owners and local authorities who are or may be responsible.

Apart from the bad condition of many of those occupied, however, there is much trouble from the lack of sufficient houses to meet the demand, with the consequent evil of overcrowding. This is often due to the competition which farm labourers experience with miners, factory workers and clerks, who prefer to live in the country if they can find a cottage within easy walking distance or a short bicycle ride of their work, and who can afford to offer a higher rent than the agricultural workers. Naturally they secure the best cottages. This leads to overcrowding, and several instances are quoted in the Report of families of 6 or 7 living in a one-bedroomed house, families of 9 or 10 living in two-bedroomed houses, and of families of 9, 10 and even 11 living in a three-bedroomed house. Unfortunately overcrowding is not regarded with dislike. In Northumberland, for instance, the owner found in a cottage with only two small bedrooms and a kitchen, a father, mother and 8 children. Another bedroom was added, but when a visit was made a few months later the same family was found with the addition of 3 lodgers. On the other hand, there is evidence that, though agricultural labourers and their wives will often put up with small, inconvenient and even insanitary cottages, they will refuse to live in places where they are isolated or distant from the centres of village life. Everywhere the ordinary labourer will prefer to live in a village and walk some little distance to work rather than occupy a lonely cottage more conveniently situated on the farm. Their wives strongly object to living at any distance from the village shop and the school. They will not live in a place where they have to send their children a long distance, possibly over wet and muddy paths, to sit in school all day with wet feet. Though the agricultural labourer is often badly housed and overcrowded, it is satisfactory to learn that on the whole the relations between landlord and tenant are good. It is true that some of the bad cottages are found on large estates owned by men who control whole villages, that some farmers turn out labourers to let the houses to other workers who offer a higher rent, and even let

the cottages on their farms for a higher rent than they pay their landlord for them, and that labourers, on quitting, damage the property by negligence or even malice. As a rule, however, the reverse is the case. Large estates in England, especially in the South, are generally distinguished by well-built, spacious cottages and ample gardens. Cottages are often let to agricultural workers at lower rates than to the industrial workers living in the same village, and it is noted that even where a labourer has notice to quit his employment and is required to vacate his cottage, the period of notice for the cottage is much longer than the period of notice for his employment.

Section (8).—Relations between Farmers and Agricultural Labourers, etc.—Good feeling appears to prevail on the whole between employers and employees. In a few counties there is some antagonistic feeling, and in one case the labourers are reported to have complained that they dare not speak if they receive less than the minimum rate of wages, for fear of dismissal, but elsewhere there is a readiness to pay higher wages, provided that there is some assurance that the profits of agriculture will permit it. The best farmers are least afraid of higher wages, and the more thoughtful employers agree that the old conditions need alteration and standardising. On the whole the labourers, too, have shown a friendly spirit, though there is evidence of restlessness and discontent among them. This is shown to some extent by the development of trade unions, but there is no reason to believe that they do not wish to accommodate their employers in every way possible. The investigators, both for Cambridgeshire and Buckinghamshire, report that the labourers were wholly opposed to strike methods. The attitude of many of the farmers to the workers' unions is not hostile, and the investigators for more than one district recorded that the employers fully realised that the labourers had been scandalously underpaid in the past, and they expressed a desire to see their conditions vastly improved. In several cases they volunteered the opinions that the Wages Board and the District Committee could not be effectively operative unless the men organised themselves. The matter is, of course, closely connected with the relative prosperity of agriculture, and the prospects that lie before it in years to come. Many farmers have admittedly done well in recent years, especially during the War, and if the present state of things continues they will be ready to meet any demands that are urged with moderation and a spirit of reasonableness.

PART II.—WALES.

The description of English agriculture and of the English farm workers' conditions of employment and general economic state does not apply to Wales. The very large industrial population of Glamorgan, Carmarthen and Monmouthshire, and in a smaller degree that of Carmarvon, the hilly and barren nature of much of the rest of the Principality, the smallness of most of the holdings, and the survival of interesting but unprogressive customs, have helped each in its own degree to keep back Welsh agriculture, especially that aspect of it which relates to the well-being of the labourer. Of all these influences, perhaps the most powerful is the system by which the cultivated area of Wales is held for the most part by small and often struggling farmers engaged in the milk industry with the assistance of their families and a few "boys," under which term are included all unmarried labourers of no matter what age. These workers generally go to work on a farm as soon as they leave school, but they have no intention of remaining in agriculture and invariably leave for the mine, the docks, or the factory after a few years, though not infrequently they return when they have accumulated sufficient savings to take a small farm on their own account. Cottages are scarce and are largely sought for by industrial workers, so that the prevailing custom is for the labourers to live in. As the workers are generally of the same social class as their employers, they often take their meals at a common table, and are on terms of greater intimacy with them than is the case with the English labourers and masters. But in the matter of sleeping accommodation their position is far worse. They are often required to sleep in a room over the stable or cowhouse, while some of the sleeping lofts are also used as hay stores from which hay is served in the racks to the stables or cowsheds below. Apart from the polluted air, these lofts are frequently dirty, draughty and generally uncomfortable, and no facilities whatever are provided to enable the lads to employ their few leisure hours to advantage. There is no fire or light at night, and the boys have no option but to seek comfort elsewhere. The results are what might be expected. The moral and physical state of the workers is lowered, there is a constant exodus to the manufacturing districts, and the standard of farming does not rise. The farmers are largely dependent on their own families for their labour, but by the ancient Welsh custom of "Cymhorthen" or mutual help, with the aid of the "bound tenants," that is to say, small holders who rent a cottage and

a plot of land for their own use and cultivation on condition of remaining in their employer's service, and by the engagement of boys from English industrial schools, the lack of hired labour is overcome. Disease, however, especially tuberculosis, is only too prevalent, and the difficulty of obtaining milk, especially in South Wales, must make matters worse. The sanitary conditions of many of the cottages are very bad and the obstacles in the way of any improvement very great. Little or nothing appears to have been done to provide for the social or intellectual needs of the labourer, or to foster in him the pride of craft and encourage him to attain proficiency in his art, though the Welshmen have in many places by their own energies found an outlet for their spiritual needs in the chapel, the Sunday School and the Eisteddfod. A feeling of bitterness, therefore, has arisen, which the investigators fear is leading to a misunderstanding between the employers and the employed. Until recently, the relations between the farmers and their men have been of a cordial character, and master and men met on friendly terms at religious and social gatherings. This still exists among individuals, but as social classes it is not so now. A gulf has been opening for some years. This is attributed by the investigators to a feeling amongst the men as a class that the farmers as a class have not permitted them to share in the comparative prosperity they have enjoyed in the revival of agriculture after the long period of depression. This is especially the case in Monmouth and Glamorgan, where contact with local trade unionism has tainted them with that bitter class hatred which distinguishes the feelings of the railway men, miners and dockyard men towards their employers. The feeling of antagonism is not confined to the men. Many farmers seem to think that the men are taking undue advantage of the shortage of labour to advance new and unjustifiable wage claims and other demands, and they also allege that the men show a decided tendency to "slack" work. In certain districts the feeling is even more intense, and the feeling of resentment against the former class seems to be very generally shared by other classes of the rural community. No attempt is made in the Report to fix the responsibility for this sad state of affairs, and, no doubt, the true causes do not lie on the surface, but little improvement can be hoped for so long as the bad housing accommodation, the long hours of work, the absence of all intellectual outlook, and the hopelessness of all effort at social and economic improvement remain the characteristic features of the agricultural labourer's life. It is in the

recognition of the community of interests, with its duties and responsibilities, and in the tacit acknowledgment of the spiritual equality of all men, no matter what their social distinctions may be, that the only hope of regeneration lies.

THE UTILISATION OF THE STRAW CROP.

THE great extension of the area under grain crops involves, as a necessary consequence, a considerably increased production of straw. The problem of the profitable disposal of the surplus of straw supplies over the normal consumption of past years has aroused misgivings in wide agricultural circles, and many inquiries have been addressed to the Board as to what steps were being taken to assist the farmer in the disposal of his surplus straw. The object of the present article is to give a summary of what has been accomplished in this direction.

It is estimated that in England and Wales the last harvest produced about 1,200,000 tons more wheat-straw and 700,000 tons more oat-straw than the average of the ten preceding years. As against this there was a drop of some 750,000 tons in the hay crop, or the equivalent for feeding purposes of fully 1,000,000 tons of oat-straw. Taking the country as a whole, therefore, it may be said that the surplus oat-straw was fully required to cover the reduction in hay supplies, and the essential problem facing the farmers was the disposal of the large crop of wheat-straw.

Under normal conditions an increased supply of wheat-straw would be chiefly disposed of on the farm by increased stocking and more liberal littering of the feeding yards, whereby larger supplies of dung are obtained. With the increased arable acreage requiring dung, the prudent farmer would naturally aim at using up his straw as far as possible in this fashion. Unfortunately, during the past winter the scarcity of feeding-stuffs and other circumstances have combined to make it difficult for the average farmer to convert the whole of his

straw into dung, and in many cases considerable quantities will need to be carried over to next winter, unless some means of disposal off the farm can be found.

The problem of the disposal of the surplus straw crop has occupied the attention of the Board since the inception of the programme for increased food production, and various possible methods of increasing the utilisation of straw, both on and off the farm, have been investigated. The investigation has followed three main lines, viz.: (1) Industrial uses of straw; (2) Enhancement of the feeding value of straw; (3) Conversion of straw into manure without the aid of the animal.

1. Industrial Uses of Straw.—There are many possible uses for straw in industry, but the only one which appears likely, if developed, to absorb a large quantity is the manufacture of *strawboards* and *paper*.

Accordingly, early in 1917, the Board instituted inquiries as to the possibility of securing a largely increased use of straw in this industry. At that time the Ministry of Munitions were taking steps to develop the manufacture of strawboards in this country, and the Board have kept in constant touch with the progress of the Ministry's schemes. At the same time, also, much has been done by individual paper manufacturers to develop the use of straw for paper-making.

These various efforts have been beset with serious difficulties arising out of war conditions. The reduction of straw to pulp for strawboards or paper requires higher steam pressure than that required for the commonly-used paper-making materials, and consequently only those mills equipped with sufficiently strong boilers could undertake the pulping of straw without the introduction of costly new equipment. The reduction of the hay crop and the great demands of the Army for forage made it necessary to impose restrictions on the use of straw, and only relatively limited quantities could be released to the paper-maker. The transport of straw to the mill imposed a further difficulty owing to the prevailing congestion of transport.

Despite these difficulties, a substantial development was effected, and it is estimated that during the past year fully 20,000 tons of straw were taken up for boards and paper-making. This is not a large proportion of the estimated surplus, but in view of the fact that the use of straw in paper and board-making in this country is a development which occurred only late in the War, it must be regarded as at least a promising start. With the removal of the restrictions on the use of straw, subsequent to the Armistice, a rapid development of the industry was hoped for, but

unfortunately a more serious difficulty has arisen in the shortage and dearness of coal supplies. The production of a ton of pulp from straw requires more steam, and consequently more coal, than is needed for esparto, and still more than for wood pulp. The proportion of coal consumed at different works varies greatly, but as a rough average it may be said that for each ton of paper produced, straw requires 7 tons of coal, esparto $5\frac{1}{2}$ tons, and wood pulp 2 tons. Under present conditions of supply and prices of coal this must operate adversely against the taking up of straw at prices satisfactory to the farmer.

2. Enhancement of the Feeding Value of Straw.—Of the ordinary products grown by the farmer, straw is the only one the use of which for fodder entails appreciable difficulties. These difficulties are least in the case of oat-straw and greatest in the case of wheat- and rye-straws which, indeed, are used as fodder only to a very limited extent. These difficulties arise from the bulky, tough and fibrous nature of straw, which not only limits the extent to which straw can be taken up into the digestive apparatus of the animal, but also seriously reduces the benefit which the animal might otherwise derive from the nutritive materials contained in the straw. This reduction is estimated to amount to more than one-half of the full value of the nutritive materials. These materials lie embedded in the fibrous tissue of the straw, and consequently the access of the digestive juices is restricted. Many attempts have been made to devise a treatment which will remove at least the more resistant part of the tissues, thus leaving a more digestible and more nutritious residue. In some cases fermentation methods have been adopted, in others chemical treatment of the straw has been resorted to.

Not much success has yet been achieved in the "improvement" of straw by fermentation methods, but a considerable measure of success has been claimed for chemical methods. The treatment which has attracted most attention in recent years is the boiling of straw with a solution of caustic soda (or a mixture of carbonate of soda and slaked lime). This process was first developed some 20 to 30 years ago by Lehmann, with a view to its introduction on the farm, but it has subsequently been developed into a factory method and worked on a large scale. Faced with the necessity during the war of making the utmost use of their home fodder supplies, the German Government decided to develop this industry on a large scale, partly by recourse to paper mills and partly by the erection of new factories. In July, 1917, the output

of treated straw from the Government factories was estimated at about 800 tons per week, and developments were in progress which would enable one-fifth of the German straw crop to be dealt with in this way.

Three processes (Lehmann, Oexmann and Colzman) are in use, differing only in such technical detail as type of boiler, strength of soda solution and duration of heating. The method is in principle the same in each case.

The chopped straw is first soaked for 24 hours in a solution of caustic soda, varying from 2 to 5 per cent. at different factories. The soaked straw is then transferred to an iron boiler (Lehmann), or covered tank of iron (Oexmann), or cemented brickwork (Colzman), and steam is blown in for a period usually of 6 hours. The soda liquor, now very dark coloured owing to dissolved matters from the straw, is run off, and the residual straw washed with water until free from soda. The washed product is then drained, in some cases pressed, and used in this moist form for feeding. If required to be transported considerable distances it must be dried. In drying it is apt to form into hard masses which require to be shredded before use.

In the treatment some 25 to 50 per cent. of the material of the straw passes into solution and is consequently lost in the waste liquor, along with the soda. This represents a serious economic waste, and consequently in the newest plants arrangements have been devised (Kinmann process) for receiving the soda, and at the same time obtaining from the organic matters in the liquor valuable by-products in the form of methyl alcohol and acetone.

The straw after treatment is a light yellow colour, has a not unpleasing smell and is readily consumed by stock. It is even poorer in albuminoids than the original straw, and hence requires to be used along with feeding-stuffs fairly rich in albuminoids, such as peas, beans, oilcakes or fish meal. Numerous feeding experiments in Germany and Scandinavia have demonstrated that it has a much greater feeding value than the original straw, the best samples proving, in mixed diets supplying the necessary albuminoids, to be fully equal to good oat-grain.

From the information available as to the German manufacture it is difficult to form a reliable estimate as to the prospects of the industry being carried on profitably when fodder supplies once more become normal. There was an obvious incentive to the German Government to "boom" the industry during the War, and consequently the frequent laudatory articles in

the German press could not be regarded as entirely disinterested. It was felt by the Board of Agriculture, therefore, that some independent investigation of the process should be carried out in this country. Accordingly, in the early part of 1918, at the request of the Food Production Department of the Board, arrangements were made for tests to be made in connection with the Agricultural Department of the University of Leeds

In view of the technical difficulties involved in carrying out experiments on a factory scale, it was decided to aim rather at devising a method which could be worked on the farm with ordinary appliances. Further, it was felt that some attempt should be made to reduce the loss and labour involved in washing the product. This latter end was secured by reducing the strength of soda solution used to such an extent that the acid substances generated by the heating of the straw neutralised the excess of soda, leaving a neutral product which could be fed direct without washing.

Preliminary experiments were made to ascertain the most suitable strength of soda solution and to test the effect of varying periods of steaming under different steam pressures. As the outcome of these experiments the following method of preparation was devised :—

The chopped straw was thoroughly soaked in a 1·5 per cent. solution of soda (about 6 or 7 gal. per stone of straw) and allowed to stand overnight. The surplus liquor was then drained away and the straw transferred to a vertical boiler, with loose cover and fitted with a steam-pipe delivering steam near the base. (This boiler is part of the ordinary farm equipment for cooking food.) Steam was blown through until the whole mass was heated up, and the steaming then continued for one hour. The condensed liquor was then drained away and the straw, when cool, used for feeding.

The product was light-brown in colour, had an agreeable odour, and was found to be readily consumed by cattle and sheep once they became accustomed to it. It was much softer than untreated straw and very easily shredded.

For the purpose of digestion trials a considerable quantity of oat-straw was treated by the foregoing process. One portion of the treated material was washed thoroughly and served for a separate digestion trial. The trials were made with two sheep which received linseed cake along with the straw (treated and untreated) except in the first period, when a diet of untreated straw and casein was used. The average composition

of the materials fed and the average digestion co-efficients are given below :—

—	Untreated Straw.		Crude Treated Straw.		Washed Treated Straw.	
	Compo- sition of Dry Matter.	Digesti- bility.	Compo- sition of Dry Matter.	Digesti- bility.	Compo- sition of Dry Matter.	Digesti- bility.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Organic Matter ..	94.70	49.3	91.50	76.0	96.01	74.8
Ash ..	5.30	—	8.50	—	3.99	—
Crude Protein (or Albuminoids)	2.34	27.6	1.28	?	1.21	?
True Protein ..	1.93	12.1	1.21	?	1.21	?
Ether Extract (Oil)	2.01	43.6	1.55	24.5	1.45	29.7
Soluble Carbo- hydrates	43.82	39.5	29.28	62.3	26.90	63.2
Crude Fibre ..	46.53	60.0	59.39	87.4	66.45	83.3
Starch Equivalent (Production)	20.1		36.6		34.8	

The soda treatment obviously caused a loss of crude protein, ether extract and soluble carbohydrates, but the digestibility of the residual carbohydrates and crude fibre is greatly enhanced. The high digestibility of the crude fibre in the treated product is remarkable, but the records of the two sheep agree closely on this point. Moreover, the results both for carbohydrates and fibre are in close agreement with those obtained in German experiments.

The loss of dry matter in the liquor drained away in the process amounts to about 20 per cent. of the original dry matter of the straw in the case of the "crude treated straw," and 33 per cent. in the case of the washed product. When allowance is made for this loss the net result of the treatment per 100 lb. of straw dry matter treated (equal in feeding value to 20.1 lb. of starch) is the production of 80 lb. crude treated straw dry matter (equal to feeding value to 29.3 lb. of starch). There is thus a clear gain of nutritive efficiency in each case (41 per cent. and 16 per cent. respectively), although in the case of the washed product the increase is perhaps hardly worth the expense and labour of preparation. The chief technical objections to the process for farm use are the risks involved in handling caustic soda and the very wet condition of the product when taken from the steamer. The former could probably be

largely obviated by using a mixture of carbonate of soda and quicklime instead of caustic soda, whilst the latter could be reduced by a little adaptation of the steaming plant. Taking straw at 70s. per ton, the above data suggest that the crude treated straw (dry) should be worth about £5 per ton. For the treatment of one ton of straw about 1 cwt. of caustic soda would be required, costing about 35s. at pre-war prices. The economy of the process under present conditions is thus very doubtful, but it merits further investigation when more normal conditions of prices, etc., have been established.

3. Direct Conversion of Straw into Manures without Stock.—In addition to the foregoing investigations at Leeds on the utilisation of straw for feeding purposes, a number of inquiries have been pursued during the past year on behalf of the Board at Rothamsted, with the object of ascertaining how excess straw might best be used for manurial purposes. The question obviously possesses importance for those districts where the production of straw is in excess of the amounts that can usually be employed as litter for stock, and still more for arable areas where little, if any, stock is kept and the need of the soil for organic manures is relatively great. Owing to the presence of a certain amount of readily decomposable constituents, raw straw may be expected to give rise to two distinct types of changes in the soil according to the conditions obtaining at any particular time. Previous experiments have shown that when simultaneous applications of straw and sodium nitrate are made to the soil, destructive changes are set up and result in a loss of some nitrogen. This also appears to take place in a soil already containing nitrate, particularly when the soil temperature is low. Consequently, the application of raw straw to the soil in winter and early spring may be expected to lead to undesirable changes and result in a depression of crop. Experiments carried out on these lines have shown that this actually takes place in the field, and consequently alternative methods of use have had to be considered.

The second type of change which is possible depends on the use of the readily-decomposable constituents of the straw for the promotion of changes which lead to a fixation or accumulation of atmospheric nitrogen by soil bacteria. With the object of avoiding the above-mentioned destructive change, and of encouraging the fixation processes, attempts have been made to pass the straw through a fermentation treatment prior to application to the field, and, in fact, it has been possible in this way to increase the nitrogen content of the straw by

20 to 50 per cent. Owing, however, to the slow rate at which other constituents decompose in the straw, the application of this enriched product to the soil in early spring and immediately prior to the sowing of a corn crop has not been found to result in definite crop increases, although, on the other hand, the depressing effect, as compared with raw straw, appears to be somewhat reduced.

A more promising method of securing the constructive or fixation processes appears to consist in the introduction of straw, either raw or previously fermented, when the soil temperature is high and favourable to the appropriate bacteria. Recent field experiments in which straw chaff was applied to land under potatoes and earthed up in the normal manner have given promising results, and it is proposed to repeat these experiments this year.

The practical objection to the fixation method of fermentation lies in the fact that, even after appreciable amounts of nitrogen have been assimilated, the straw still retains its external form and is in no sense of the term "rotted down." With the object of securing material which should resemble farmyard manure in physical and chemical properties, investigations have been carried out to determine the conditions favourable to complete rotting, and from these some interesting results have emerged.

In the first place, effective rotting and disintegration of straw (wheat-straw was used in all experiments) have been found to occur only when free access of air to the material is provided. Any exclusion of air, by water-logging, quickly suspends the process. In the second place, some source of soluble nitrogen is essential, and this may be supplied in the form of urine or of one of a number of chemical compounds mentioned below. The vital importance of urine for the rotting process is most striking, while dung (solid excrement), either alone or in conjunction with urine, does not appear to increase the rate of breakdown.

More importance, however, attaches to the fact that to get the best results a certain concentration of nitrogen is necessary, and that the urine of ordinary farm animals is generally much in excess of this concentration. One is thus faced with the choice either of losing some proportion of this valuable form of nitrogen or of reducing it in strength approximately to the favourable concentration. Where the latter course has been adopted it has been found possible to reduce wheat-straw to a well-rotted condition without any of the losses of nitrogen

that ordinarily occur in the making of manure, in spite of the fact that the fermentation period extended to upwards of six months.

Although these results do not necessarily affect the general method of making manure, they appear to indicate the possibility of using excess liquid manure or such drainage as may be obtainable from cowsheds and stables for the fermentation of surplus straw, and for bringing about an appreciable augmentation of the supplies of organic manures produced on the farm.

The natural extension of these results may be found to lie in the direction of producing "synthetic" farmyard manure. Up to the present it appears to be perfectly feasible to prepare well-disintegrated straw manure by the employment of straw with the addition of chemical compounds, such as urea, ammonium carbonate, ammonium sulphate, etc. Larger-scale experiments are, therefore, now in progress, with a view to standardising the conditions to be arrived at in practice.

From the foregoing summaries it is clear that the mere treading into manure by no means exhausts the possibilities of utilisation of the straw crop. There is an obvious temptation to adopt the simple expedient which a development of the use of straw in paper-making would furnish, but from the point of view of agriculture this must be regarded as doubtful economy. The aim of the prudent farmer with an increased arable acreage will be, firstly, to increase his manure production to the fullest possible extent, and secondly, to reduce his feeding costs. Only when he has exhausted the possibilities in these two directions should he contemplate the removal of straw from the farm. With the prospect of reasonably good prices for produce, meat and milk next winter, a full supply of straw may be regarded as a substantial asset.

THE PATHOLOGY AND EPIZOOTIOLOGY OF LOUPING-ILL.

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THE writer has been engaged for some years past in investigating the destructive disease of sheep known popularly as louping-ill, the distribution and depredations of which are well known to farmers. The full experimental results of the investigation have been published in detail in the *Journal of Comparative Pathology and Therapeutics*, September, 1916, and September, 1918, to which reference can be made for fuller information.

The object of this article is to present, in a more or less popular form, the fundamental conclusions arrived at and deductions therefrom, likely to be of value in practice, omitting experimental and scientific details where they do not seem necessary to explain the results.

The General Position at Beginning of Investigation.—Louping-ill being a seasonal disease, it was only possible to obtain material for investigation during comparatively short periods in each year. The disease originally received its names from, and was identified by, laymen, the naming being based on one or more outstanding symptoms, and not on any definite pathological character. The inevitable result of this was that different conditions of disease with somewhat similar symptoms were frequently regarded as identical, and wrongly grouped under one name, leading to much confusion as to what was louping-ill and what was not. The question of ticks being a factor in the causation of louping-ill had been discussed from time immemorial both by farmers and scientists, but always apparently in a somewhat partisan spirit, most preferring to accept the tick theory in a doubtful way or reject it, according to how the circumstantial evidence appealed to them individually, but no serious attempts were made to examine the tick question methodically and scientifically. It is not surprising, however, that very divergent opinions obtained, both as regards the pathology of the disease and the evidence for and against the ticks, since, having regard to the certainty that more than one diseased condition was being viewed under the same name, the epizootiological data collected were inevitably divergent.

. A view which had a certain number of adherents, and one which obtained some support at least from the more or less enzootic character of the disease, was that it arose from soil or forage infection of some kind.

The disease had been previously investigated by several pathologists and others, working singly or as committees appointed by Government Departments, or agricultural societies. Various claims had been made to the discovery of the cause of louping-ill, all of which rested on having isolated different bacteria from an animal alleged to have died of the disease, and on causing illness or even death by inoculating cultures of such microbes. Such a method, particularly when applied to sheep diseases, invites error, because a dead sheep putrefies with extraordinary rapidity when not disembowelled, and the putrefactive bacteria in the intestines which quickly invade all the tissues and organs are most harmful to animals if inoculated. None of the alleged causal bacteria, however, gave rise to a clinical or post-mortem picture which could be referred to louping-ill, although the inoculation of some of them caused illness or death. The obviously correct method of only using material taken from affected sheep during life, or from those which had been slaughtered instead of being allowed to die, never seemed to have been methodically followed.

Methods Adopted for Preliminary Inquiry.—To disentangle the apparent confusion and arrive at definite lines upon which to conduct an experimental investigation, preliminary inquiries were undertaken as follows :—

1. By selecting for the initial work only those cases in the field which might be looked upon as having a clinical or post-mortem entity; these were all collected from notoriously infected farms.

As regards naked-eye lesions the matter turned out to be simple in one sense, as it eventually became evident that the only really constant lesion was swelling and dropsy of some of the lymphatic glands, sometimes with congestion. This, however, in no way explained the symptoms. The possible bacteriological aspect of the disease was settled as regards microscopically visible microbes (there are microbes too small to be seen by the microscope) at a comparatively early stage of the investigation by finding that the fluids, tissues, and juices of animals which were slaughtered in various stages of the disease instead of being allowed to die were invariably sterile on media, that is to say, they contained no visible bacteria at all.

As regards clinical symptoms, it was found after careful sifting that cases could be grouped under four heads :—

(a) The animal may be found down in a senseless and completely comatosed condition with the head drawn round towards the shoulder, having lost all power to maintain itself on its legs, although the legs may be capable of performing paddling movements when the patient is laid on its side.

(b) The patient may be found down but quite sensible, the anterior, or posterior, or both extremities, being paralysed

Along with these basic nervous symptoms others, such as general trembling, twitching of the muscles of the jaw, and frothing at the mouth, may be seen.

(c) It was said by many shepherds and flock-owners, and it agreed with the writer's observations, that every sheep reared on or brought on to louping-ill pastures passes through an attack of the disease in some form. If it survives, it becomes highly resistant to further attacks, at least in a dangerous form. Many sheep, however, never show objective symptoms visible to the ordinary observer, but shepherds and flock-owners of experience can pick them out as affected. This means that louping-ill may assume the form of a more or less slight indisposition.

(d) The indisposition may be somewhat greater than in (c) and the animal may lie down continuously apart from its companions, only rising at intervals to move a short distance, and then lying down again, or it may only move when chased.

For the purposes of investigation only cases showing the distinctive paralytic symptoms were chosen in the first instance, the object being to avoid as far as possible the inclusion of other diseases, although no doubt many mild cases of louping-ill were thus excluded at first. When a lesion, such as an abscess, was found in a position in which it might possibly have caused paralytic symptoms, by pressing on the brain or cord, for example, the case was also rejected. Following this method of eliminating more or less doubtful material it became apparent that a definite diseased condition existed, having for its distinctive symptoms those described under (a) and (b). On microscopical examination of the brains and spinal cords of such cases they showed more or less definite lesions which need only be referred to here as those of myelo-encephalitis (inflammation of the spinal cord and brain), and it was found at a later stage of the investigation that the milder and also the experimentally induced cases showed the same changes in a lesser degree.

2. It seemed important to sift and analyse the circumstantial evidence for and against the ticks as a factor, and to make further observations in connection with the various statements which have been made in this connection. This resulted in the adoption of the following definite conclusions :—

(a) Ticks are always present on the pastures where true louping-ill exists, although it has been asserted that this is not so. It is true, however, that the disease may be unknown on land infested by ticks, but this may only mean that the ticks on such pastures have never had the chance of becoming infected.

(b) Louping-ill is a seasonal disease occurring chiefly in April, May, and early June, and to a less extent in autumn; and these are the times when ticks are most plentiful in various stages, ready to feed, and, therefore, ready to infect, if they carry an infecting agent.

3. The questions of soil or forage infection had been experimentally examined to some extent by putting muzzled and unmuzzled sheep on infected pastures, the former being removed daily for feeding in a shed. This form of experiment was repeated by the writer, the result being, as in other cases, that disease appeared in both sets of animals, though its incidence sometimes favoured the one and sometimes the other. The writer also supplemented his observations in this respect by attempts to convey the disease by means of forage cropped from infected pastures, by feeding the actual soil of these pastures, and by inoculating the same material. The results were invariably negative.

Returning for a moment to the most constant naked-eye lesion, namely, the oedematous lymph glands, a very thick creamy juice was found in their medullary portions when cut into. Smears made from this creamy material when stained by Geimsa's stain showed peculiarly staining bodies to which the provisional name of "chromatin bodies" was given, meaning that they took up the distinctive part of the stain. The condition of the glands and the presence of these bodies suggested that inoculation with this material might be followed by interesting results.

Inoculation Experiments.—As already mentioned, previous investigators had failed to produce louping-ill by inoculation. This arose because they did not methodically make use of fresh tissues and juices, and, therefore, did not hit upon the virus-containing material, or because they were intent upon establishing as the cause of the disease a microbe which they had isolated from dead tissues.

The actual experiments began with material taken from an affected lamb sent up alive to the Laboratory from an infected farm which was being used as a field observation station. On arrival it showed the disease in one of its distinctive forms, its hind legs being completely paralysed. It was killed by bleeding. All the organs and tissue juices proved sterile on media. Typical microscopical lesions of the cord were evident (see figures of lesions and description). The cells of the oedematous glands and of the blood showed chromatin bodies.

Two ewes and two lambs were inoculated subcutaneously with 5 cc. of an emulsion made from the oedematous glands of this lamb.

One ewe became distinctly ill on the eleventh day, and died paralysed on the thirteenth.

The other ewe became very ill on the twelfth day. It was dull, listless, and disinclined to move, but had apparently recovered on the sixteenth day.

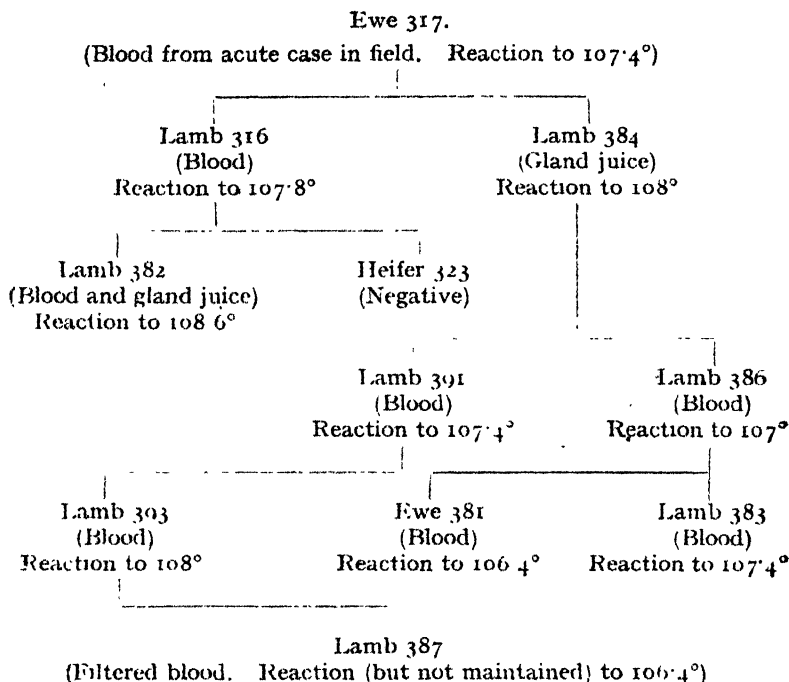
Both lambs became ill on the ninth day, and died paralysed on the twelfth. The three animals which died showed typical lesions in the brain and cord, and chromatin bodies were present in the swollen glands. The bodies were present in blood smears from all four inoculated animals, but as one recovered its glands were not examined.

These are only selections from a large number of experiments, and at the time the results were obtained they were not regarded as conclusive evidence that louping-ill could be conveyed experimentally by inoculation. They were repeated and added to at a later date, and it was definitely confirmed that the disease could be conveyed to healthy sheep at the Laboratory, several hundred miles away from any infected farm, by inoculating the blood or material from dropsical glands taken from sheep suffering from naturally-contracted louping-ill in the field. These were the only tissue fluids found to be infective, and it may be noted here that it was in these fluids only that the "chromatin bodies" were present.

One of the inoculation experiments carried out at a later date may be given here. It is selected because it included a large number of animals, and can be given shortly in tabular form.

Ewe 317 was inoculated with blood obtained during life from an acute and ultimately fatal case of louping-ill in the field.

The diagram shows the result, together with the results of sub-inoculations. The temperatures given are Fahrenheit.



These results show that the disease can be transmitted in series from susceptible animal to susceptible animal, provided the proper materials—blood and gland juice—are used for inoculation. This means among other things that the causal agent of the disease is not a toxin but a living virus capable of reproducing itself in the bodies of fresh animals to which it gains entrance. It is probable, however, that the living virus itself during its growth in the sheep manufactures a toxin which acts on the nerve cells, for, although the nerve centres show the most important lesions which give rise to the symptoms, they do not contain the virus, as they do not set up the disease when inoculated to other sheep.

With regard to Lamb 387 (filtration experiment), it received 1,000 cc. of blood which had been diluted for filtration, corresponding to about 50 cc. of undiluted blood.

The rise of temperature to 106.4° occurred on the following day, and was not maintained. It was due to the large amount of material which was injected into the hind leg, causing temporary lameness, and was not due to a virus. After the second day it fell to normal.

A virus may be too small to be seen even by the highest powers of the microscope. Such a virus is said to be ultra-microscopic. If a virus is ultramicroscopic, it passes through the fine pores of a bacterial filter which retain most of the microscopically visible organisms, whether bacteria or protozoa. It is said to be filterable, and the filtrate is virulent, whereas the filtrate from a large virus like anthrax, for example, is harmless. If, then, a virus does not pass the filter it should be visible to the microscope, and further, the virus of louping-ill cannot be a dissolved toxin, as this would pass with the filtrate. As very definite information seemed desirable on the question of whether the virus was filterable or not, a further experiment was designed, using an emulsion of oedematous lymph glands in which the virus seems to be specially concentrated. Oedematous glands were removed from an affected sheep which had been slaughtered. These were chopped up and made into an emulsion with sterile liquid. A small dose of this emulsion was inoculated to a sheep which became affected, and had a temperature reaction up to 107.8°. Another sheep was inoculated with the same material after filtration. It showed no temperature reaction and no symptoms.

The virus of louping-ill, then, would appear to be non-filterable, and therefore microscopically visible.

The fact that louping-ill proved to be inoculable from animal to animal, however, did not fully explain the disease, because it was difficult to see how the virus, situated as it is, got outside the body of an affected animal, and it was well known that the disease did not spread by ordinary contact, that is to say, if healthy animals are kept in a loose box with the affected, the former do not contract the disease. When a disease is inoculable but not contagious by actual contact, although multiple animals become affected about the same time, there is a strong probability that contagion is carried by an intermediary which plays an important part in the life cycle of the causal agent, the latter requiring two hosts, often a vertebrate and an invertebrate, for its development. On account of the circumstantial evidence already referred to, the tick seemed well worth submitting to methodical investigation, more especially as it was well known that ticks are blood-suckers, and the experiments had proved that the virus of louping-ill is present in the blood of affected animals.

Ticks as Carriers of Disease, and Tick Experiments.—The sheep tick which prevails exclusively on infected farms is the *I. ricinus*. Many observations were made by the writer

on the habits of this tick as seen on loup-ill pastures, but only a few of these need take up attention. The *I. ricinus* is known as a thrice-sucking tick, which leaves its host, and moults on the ground, each time after engorgement, that is to say, it requires three vertebrate hosts for its full life-cycle. The prevalence of this or that stage of the tick on the pastures, then, at a particular time of the year, depends to some extent on whether its hosts are available to enable it to pass from one stage to another. On these pastures sheep are available, and larvæ nymphæ, and adults are exceedingly plentiful in April and May. All forms are again found in August, September, and October, but not so plentifully. These, as already mentioned, are the loup-ill seasons; but the main damage is done in the spring, because of the advent of new lambs, which provide fresh and susceptible fuel for the disease, most of the old stock having become highly resistant to the disease by the autumn. If, however, sheep of any age from clean farms be introduced at these seasons, the losses may be enormous. Ticks may cause disease in more than one way. Certain species are believed to inoculate a formed toxin or poison after the manner of a snake. No such tick, however, was known in Great Britain, and the facts were against the sheep tick acting in this way, if it acted at all, because the virus of loup-ill, as shown, could be passed on by the propagation of the virus inside sheep from one animal to another, which is contrary to what happens with a toxin or poison. The virus, moreover, was shown to be retained by the filter, which allows dissolved toxins to pass. The most usual method of infection by ticks depends upon specific protozoan parasites of microscopic size which are parasitic in one stage in the ticks and in another in the vertebrate hosts of the ticks. That is to say, the life cycle of these parasites can only be carried through if they find the suitable species of tick on the one hand and the suitable species of vertebrate on the other. A parasitised tick may puncture the skin, and imbibe the blood of a vertebrate animal unsuitable to the protozoan parasite, in which case no harm results to the tick's host. If, however, the vertebrate animal is suitable to the protozoan parasite, and the latter is pathogenic (disease causing), a specific disease may be set up, and the vertebrate species is classed as susceptible to that disease. The protozoa or animal-cell parasites reach their highest or sexual stage in the ticks. Here by completion of sexual development and sexual junction the resulting cells are endowed with an extraordinary capacity for division

and redivision or asexual multiplication (schizogony). The latter begins when the fully-mature parasite is transferred from the tick to the susceptible vertebrate. These sexual forms continue their multiplication by division and to some extent their development in the blood stream or organs, and it is owing to the presence therein of forms capable of repeated division that the blood of infected animals is virulent to others by inoculation, that is to say they continue to multiply asexually when transferred to another host by inoculation. It is also owing to the presence of certain forms in a further stage of development in the blood that the ticks become infected by the potentially sexual forms when engorging with the blood of the vertebrate animal.

From the above it will be apparent why an animal suffering from a protozoan disease is not infective to others by ordinary contact, although its body fluids may be made to convey the disease by inoculation, which is not a natural but an experimental method.

Figure 1 shows the various stages in the life cycle of this tick—unfed larvæ (*a*), engorged larvæ (*b*), unfed nymphæ (*c*), engorged nymphæ (*d*), unfed adults (*e*), engorged females (*g*), eggs laid by the latter (*h*). The eggs are laid to the number of about 2,000 per female. The males (*f*) do not engorge. After each stage has engorged, it drops off the animal and spends a moulting stage on the pastures. This stage lasts one month or generally several months, the length of time depending to some extent on the temperature, and this at least partly accounts for the seasonal character of a tick-borne disease in this country. When the moult is complete and the next phase is reached, the tick is flat, and ready to feed again. If in one stage it has imbibed a virulent blood, the parasites therein may have developed by the time the next stage is reached, in which case the tick may be infective when it next feeds. It will be seen, therefore, that the larvæ might infect themselves and be carriers as nymphæ, while the nymphæ might infect themselves and become carriers as adults. The adults might infect themselves, but in this case the utilisation of vertebrate hosts having come to an end, the engorged adult plays no further part in infecting animals, unless, which is sometimes the case, infection passes through the eggs to the larvæ. Should this happen the larvæ might be infective without further contact with infected animals. Assuming louping-ill to be a tick-borne disease, the above were the hypothetical possibilities which had to be examined experimentally to disprove the assumption, or establish it as a fact.

Engorged female ticks were obtained from affected sheep in the field in May. At the Laboratory, several hundred miles away from the nearest infected pastures, they were kept under suitable conditions for laying and hatching. By the end of July a plentiful supply of larvæ was available from these ticks. In September the larvæ in comparatively small numbers were put to engorge on susceptible sheep. The first trials gave apparently negative results. These apparently negative results were, however, open to one of two interpretations: either the larvæ were not infective, meaning that infection did not pass through the eggs, or it passed to such a small proportion of larvæ that a great number would have to be used to obtain infection. The experiments were repeated, using 2,000-3,000 larvæ, such a number as a sheep might easily get upon its face by grazing up against clusters of hatching eggs.

One sheep so infested with these larval ticks died on the seventh day showing symptoms of the disease; another showed a maintained temperature reaction up to 107° and symptoms of the disease, but it recovered. Others showed lesser temperature reactions and slight symptoms.

Engorged nymphæ were obtained in May from a sheep affected with louping-ill in the field. They were kept under favourable conditions for moulting at the Laboratory, where they moulted in July to adults. Three of these unfed adults were put on a sheep to feed, but only one engorged. The temperature of this sheep began to rise after a week. On the twelfth day it was 107° ; the reaction continued up to 107.4° for seven days. The sheep was very ill and showed symptoms of louping-ill. One adult tick in this case set up an attack of the disease.

"Chromatin bodies" were found in these sheep reacting to ticks. Blood was drawn from them during the reaction to ticks and inoculated to other sheep, and a temperature reaction followed in the latter with symptoms of louping-ill. In the sheep which died or were slaughtered for examination, lesions identical to those seen in natural cases of louping-ill were found (see figures of lesions).

Lastly, ticks bred at the Laboratory were put to feed on sheep which were reacting to inoculation with blood from another reactor reacting to infective blood obtained from the field. The ticks engorged, and after they had moulted to their next stage they were put to feed on another sheep. About the sixth day the temperature reaction began in this sheep. It rose to 108° and lasted seven days, symptoms of louping-ill being shown.

"Chromatin bodies" were found in its blood during the reaction.

It seemed also important to test whether once infected ticks had fed on a susceptible or insusceptible animal discharged their infection and became harmless, because, if they did, it might be possible to purify some infected pastures by grazing insusceptible animals thereon. A few experimental observations were made to this end, but the results being curious, they must be repeated before a final opinion can be arrived at. Infected larvæ placed on sheep did not give disease in their next stage when put to feed on another sheep. In another case, however, the infected larvæ were fed on a rabbit, and after moulting to nymphæ were put on a sheep. It reacted.

Duration of infectivity in the sheep.—In some protozoan diseases the causal parasites persist for a very long time, even years after recovery, in the blood of the vertebrate host. The blood of such recovered animals is infective by inoculation, and it can also infect ticks. Such a disease is obviously difficult to get rid of, as the recovered animals continue to act as cisterns for the upkeep of infection and to convey it to the ticks. The question of whether sheep recovered from louping-ill remain cisterns of infection was tested by inoculating their blood at intervals after recovery. It was found that the blood loses its infectivity shortly after the febrile period has passed off.

Immunity.—Some sheep appear to be naturally more resistant to the disease than others—at least some die when exposed to natural or artificial infection, while others recover. It seemed important to ascertain whether those which had reacted to inoculation and recovered would resist further infection. Three such animals were reinoculated thirty-four days after the first inoculation; two resisted, and the third gave a reaction to a very large dose of virus, but recovered. Sheep which had been inoculated at the Laboratory in the spring of one year were exposed on an infected farm in the following spring; all survived, while six out of twelve (50 per cent.) unprotected sheep became ill of louping-ill, and four died (33·3 per cent.).

The Causal Agent.—It has been explained that all the known tick-borne diseases are due to inoculation by ticks of a protozoan parasite. That there is such a parasite in the case of louping-ill, which may now be classed as a tick-borne disease, need hardly be questioned. It is probable that the parasites act by manufacturing a soluble toxin in the system of the sheep

during their growth. It also seems probable that this toxin has a selective action on the central nervous system, for, although the brain and cord are not virulent by inoculation, they are the site of decided lesions. Perhaps the identification of the parasite loses much of its practical importance now that the disease is known to be carried by ticks, and that immunity can be induced, since these are the main facts of importance as regards prevention and eradication, but it is of great scientific interest. "Chromatin bodies" have been mentioned, and while there is much to be said in support of these being the causal parasites, it cannot be definitely asserted or denied until this question has been submitted to further investigation.† It would overload an article of this character to discuss this subject at length on the knowledge available, but the evidence in favour of the parasitic character of the bodies may be given shortly as follows :—

1. Louping-ill is now shown to be tick-borne, therefore it arises from a protozoan parasite.
2. Experimental inoculation is successful only with the fluids and organs of sheep containing these bodies.
3. The bodies invade certain of the white blood corpuscles and stain after the manner of parasites.
4. The causal agent of the disease is apparently visible to the microscope, as it does not pass the coarser bacterial filters, and the chromatin bodies are the only abnormal objects which can be seen in infective material with the microscope.

The "chromatin bodies" (Figs. 2 and 3) are to be found in the single-nucleated cells of the dropsical lymph glands and of the blood. They are of microscopic size. In shape they may be round, oval, rod-shaped, or pear-shaped. Sometimes they are arranged in rosettes; several may also be arranged circularly with a clear space in the centre.

Microscopical Lesions.—The lesions may be described generally as those of inflammation of the cord and brain, the large motor cells of the cord being especially affected by the toxin. When these cells are destroyed, groups of muscles whose nervous nutrition they preside over become paralysed, and the greater the cell destruction the more extensive and complete the paralysis. Slight lesions explain to some extent the milder cases characterised by lethargy, while an extensive destruction results in more or less permanent paralysis. Paralysis of an important organ causes death. The small vessels of the central

part or grey matter of the cord are intensely congested and inflammatory cells leave the vessels and accumulate as dense foci in the nerve tissue. Some of the small vessels may rupture, causing hæmorrhage into the substance of the cord. A better idea of these lesions will be obtained by examining Figs. 4 to 12, and it will be noted that the lesions arising in natural cases and from experimental infection by ticks, and by inoculation, are identical.

Species of Animals Affected.—It has been said by some, but on evidence which is not strong, that cattle, pigs and poultry may suffer from louping-ill. Repeated attempts were made to infect these species, and also rabbits, guineapigs and pigeons, but all with negative results.

Cure, Prevention, and Eradication.—As regards *cure*, many trials were made with various and likely drugs. None had a specific effect on well-established cases. What their value was on milder cases cannot be assessed, as such cases may recover without treatment.

As regards *prevention*, it may be said in a general way of tick-borne diseases that artificial infection by inoculation is generally milder than that arising from tick infection. It has been shown that inoculated animals after recovery went through a louping-ill season on infected pastures and survived. The applicability of preventive inoculation on infected pastures must be tested, however, on a much larger scale before it can be stated to be of general utility. This much might be said, that it is probable high-class rams could be immunised, and soon afterwards allowed to run with the naturally immune ewe stock on infected pastures. New breeding stock might be artificially immunised in the spring season when infective blood is easily procurable, and put on the pastures shortly afterwards when the reaction has ceased. It may even prove possible to keep a suitable virus at the Board's Veterinary Laboratory, and supply it at almost any time.

As regards *eradication*, this obviously depends on freeing the pastures from ticks or keeping them down to a negligible quantity, or depriving them of their pathogenic power. The observations and experiments provide a full explanation of how the disease is kept up on the pastures from year to year and its seasonal incidence. The ticks are responsible for the up-keep of louping-ill and its spread. The seasonal incidence arises from the fact that ticks infected on sheep in the spring have hatched out or moulted by the autumn, and are then ready to infect; those engorged in the autumn are in a position

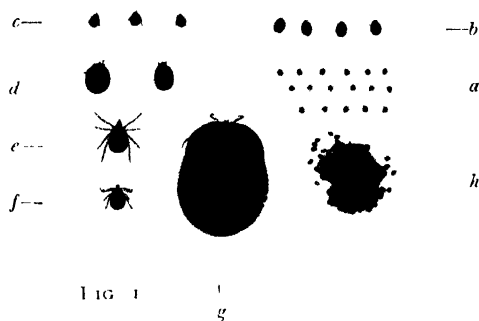


FIG. 1

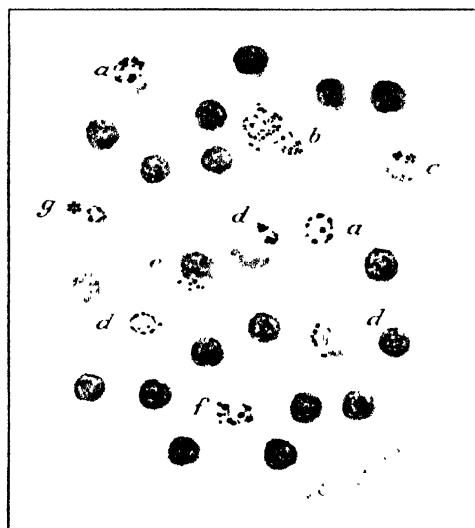


FIG. 2

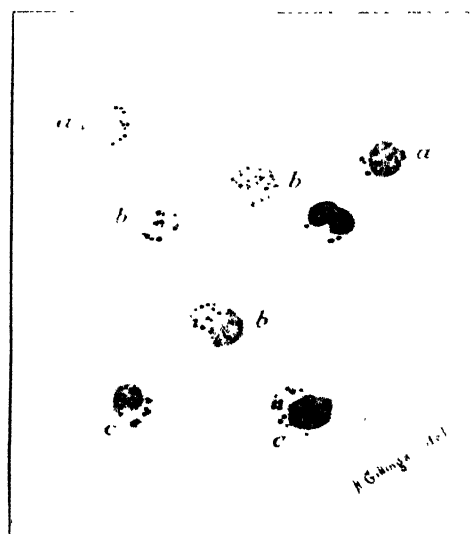


FIG. 1.—Photo of the various stages of the tick *U. varians*. (a) United female tick on an infested sheep. (b) Engorged larva. (c) Engorged nymph. (d) Engorged nymph. (e) Engorged nymph. (f) Engorged nymph. (g) Engorged nymph. (h) Engorged nymph. (i) Engorged nymph. (j) Engorged nymph. (k) Engorged nymph. (l) Engorged nymph. (m) Engorged nymph. (n) Engorged nymph. (o) Engorged nymph. (p) Engorged nymph. (q) Engorged nymph. (r) Engorged nymph. (s) Engorged nymph. (t) Engorged nymph. (u) Engorged nymph. (v) Engorged nymph. (w) Engorged nymph. (x) Engorged nymph. (y) Engorged nymph. (z) Engorged nymph.

FIG. 2.—Cells from dropsical lymph gland of natural case of louping-ill showing the "chromatin bodies" which stain like protozoan parasites inside the white cells; a—g show the various forms these bodies may assume and how their number varies in different cells.

FIG. 3.—Cells from the blood of an experimentally produced case of louping-ill showing similar "chromatin bodies" in the white cells. The large dark body is the cell nucleus, around it is the cell body, and in the body, in the nucleus or in both, are seen the densely-staining "chromatin bodies."

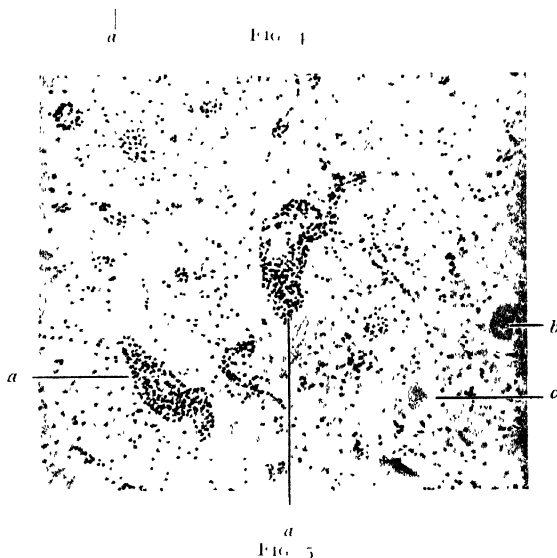


FIG. 4

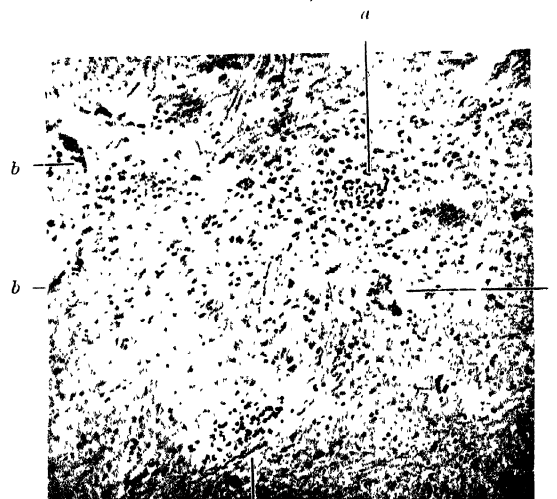


FIG. 5

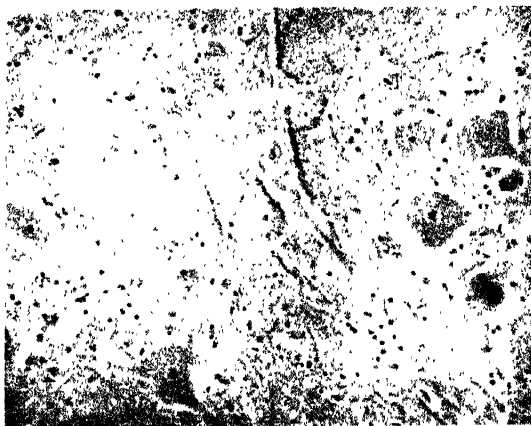


FIG. 6

FIG. 4.—Section through internal (grey) part of spinal cord of a healthy sheep. (a) Large motor cells. Observe the healthy appearance of the cells and their nuclei, and that there are no congested vessels or haemorrhages or inflammatory cells. (b) Nerve fibres. (c) Large areas of inflammatory cells thrown out into the tissue. (d) Large motor nerve cell (these cells preside over motor functions) which is still healthy and shows a stained nucleus in its substance. (e) Another large (motor) nerve cell which is dead; the nucleus has not stained. Stain haematoxylin and eosin. magnification $\times 200$.

FIG. 5.—Section through internal part of spinal cord of a case (dumb) caused experimentally by inoculation of blood from a natural case of louping-ill, died 16th day. (a) Inflammatory cells thrown out into tissue; at other parts, they are less dense. (b) Congested vessels crammed with blood cells which show as small dots. Stain haematoxylin and eosin, magnification $\times 100$. Note the similarity of the lesions to those of the natural cases.

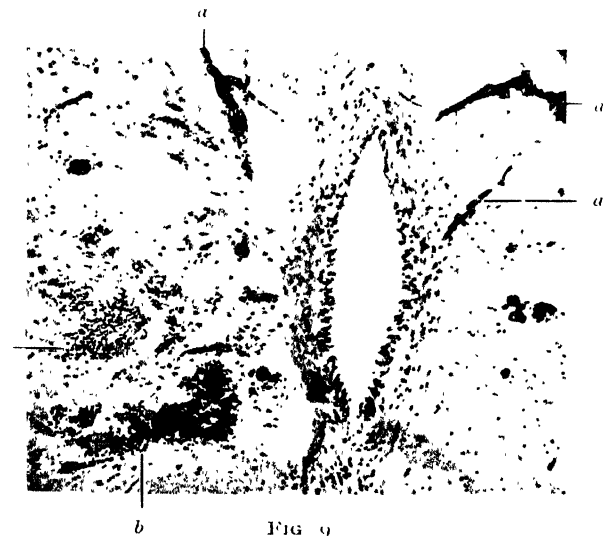


FIG. 9.

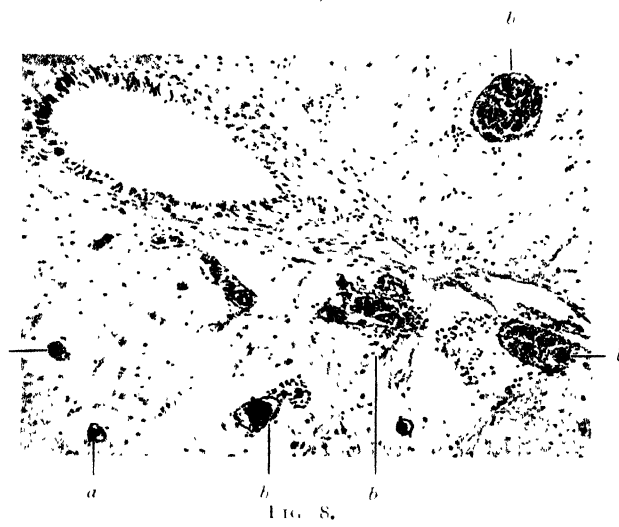


FIG. 8.

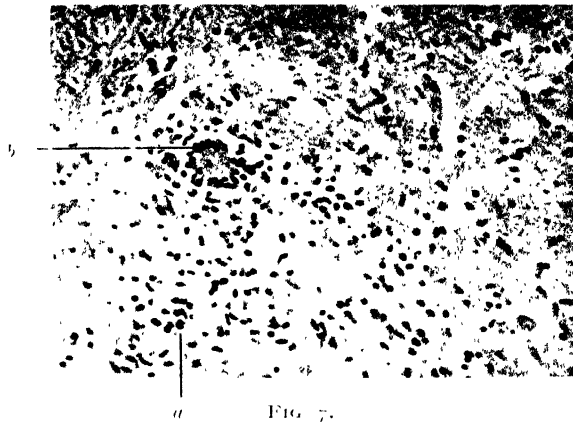
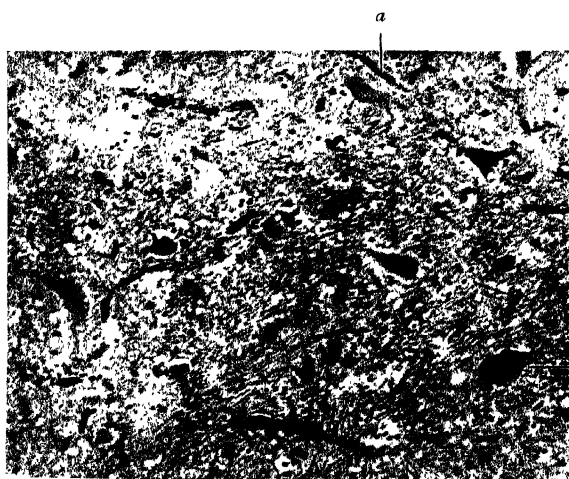


FIG. 7.

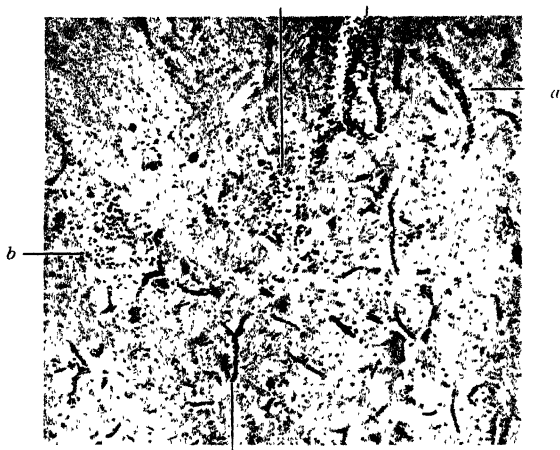
FIG. 7.—Same case as Fig. 6, but magnified $\times 200$. (a) A large motor nerve cell being invaded and destroyed by the inflammatory cells. (b) A large motor nerve cell including the central canal of experimental case (lamb) caused by inoculation of gland juice from natural case of louping-ill, died 6th day. Magnification $\times 200$. (a) Intensely congested vessels crammed with blood cells. (b) Same, showing inflammatory cells moving out of the vessels into the tissues.

FIG. 8.—Section through internal part of spinal cord, including the central canal of experimental case (lamb) caused by inoculation of gland juice from natural case of louping-ill, died 6th day. Magnification $\times 200$. (a) Intensely congested vessels crammed with blood cells. (b) Same, showing inflammatory cells moving out of the vessels into the tissues.

FIG. 9.—Section of cord of another experimental case caused by inoculation of gland juice. Magnification $\times 100$. Died 11th day. (a) Intensely congested vessels full of blood cells. (b) Here the vessels have ruptured, and blood cells have escaped into the tissues (hemorrhages). Around the central canal there are many inflammatory cells.



a FIG 11



b FIG 10



b

a

FIG. 10.—Section through internal part of spinal cord of natural case of looping, all (lamb). Magnification $\times 100$. (a) Congested vessels showing in the photo as black lines (b) Small hemorrhages into tissue (c) Large vessels congested and showing cells passing through their walls.

FIG. 11.—Section through internal part of cord of experimental case (lamb) caused by inoculating gland juice from case shown in Fig. 10. Magnification $\times 100$. Died paralysed on 12th day. (a) Congested vessels. (b) Inflammatory cells invading the nerve tissue.

FIG. 12.—Section of internal part of spinal cord of case (lamb) died experimentally by larval ticks. Died completely paralysed on 7th day. Magnification $\times 100$. (a) Congested vessels. (b) Dead motor nerve cell without nucleus and becoming invaded by inflammatory cells.

to infect other sheep in the following spring. The spring louping-ill or tick season is the worst on account of the new and susceptible lambs. The odd cases which may occur between times are due to infected and fasting ticks which previously failed to obtain a vertebrate host.

The methods of eradication and their possibilities are here indicated :—

(a) Ticks may be attacked by removing their hosts and trying to starve them out, but, as the *I. ricinus* can live for a year or more in the fasting condition, this method is not promising. On the other hand, it does not follow that because the ticks retain viability for long periods they necessarily retain infectivity. One of the subjects for future investigation will be the duration of infectivity in fasting ticks, if this method of attack is to be utilised. It may be said, however, that one attempt to obtain information on this question in the field has already been made during this investigation. Three separate paddocks were fenced off on a badly-infected pasture. One of them was kept as a control, and sheep were allowed to graze therein. Another was kept empty from one season to another. A third was kept empty, and an attempt was made to burn the grass, but it was unsuccessful. All three paddocks were found to be infected in the following season. This observation must be repeated and controlled by experiments with infected ticks at different periods after infection.

(b) Should it be shown definitely by further inquiry that infected ticks cleanse themselves by feeding on insusceptible animals, it would be possible to get rid of infection by removing sheep from the pastures and grazing other stock for one or two seasons. This possible method, however, loses much of its practical importance from the fact that many of the infected pastures are unsuitable for stock other than sheep, but it might be applicable to certain fields.

(c) The ticks can be enormously reduced by stocking heavily different parts of the pasture in turn to collect large numbers and frequently dipping the vertebrate hosts in a suitable anti-tick bath, and by other methods of de-ticking. As explained elsewhere (see p. 24) effective dipping against ticks must be carried out at short intervals of five days, and sheep can tolerate such dippings. This arises from the fact that in some of its stages the tick only remains on the sheep for five days; it may even be less. To catch the greatest number of ticks on the sheep, however, the dipping must be carried on during the louping-ill seasons,

and the observations seem to indicate that the dipping of sheep while suffering from louping-ill, as many then might be, increases the number of severe or paralytic cases. This does not necessarily apply to the old stock on the farm, which are highly resistant, or to those which have been immunised by inoculation of blood, and it is probable such sheep could be dipped without much risk.

It is not improbable that the solution of the problem will be found in a combination of the above methods, and trials in the field should be organised by farmers themselves to determine this. It should be noted by those who may think dipping impracticable, that in the Colonies and the United States, huge extents of unhealthy tick-infested land have been rendered safe and profitable for cattle breeding by an organised system of periodic dipping instituted either by Government intervention or private enterprise. An objection to dipping sheep against ticks is that in the spring, when by far the greatest number of ticks are available for destruction, the lambs have come on the scene. The importance of this objection is exaggerated, and, of course, it does not apply in the autumn tick season, but there are then fewer ticks. A very important supplementary measure to dipping for de-ticking is to cause the fully engorged ticks which have loosened their hold to be shaken off in a confined space where they can be destroyed. The sheep should during the tick season be quietly and frequently driven into a pen littered with damaged straw, hay, or other dry and combustible rubbish. They should not be too tightly crowded, being given room to move freely when chased round. They should then be hustled round the pen several times to shake off the engorged ticks. After the flock has been thus passed through the pen in batches, a little paraffin is sprinkled on the litter, and it is set on fire. This method alone will enable an enormous number of engorged ticks to be destroyed, and it should be borne in mind that every engorged female accounted for means that about 2,000 eggs for the up-keep of future generations are prevented from being laid. The writer can say from personally supervised trials that thousands of ticks can be collected and destroyed in this way. He does not mean to indicate, however, that the method could take the place of dipping in a scheme of eradication. It is a good and almost essential supplement to dipping, and can be done in the collecting pens or runs at the time of dipping. Until a dipping scheme can be properly organised, de-ticking in pens alone is

worth carrying out, as it will greatly reduce the number of ticks. Lastly, when a lamb or sheep is found suffering from louping-ill, it would be well to remove it to another special pasture not used for lambs or imported sheep, where the infected ticks dropping off can be destroyed, or where at least they will have no chance of engorging on other sheep. This, however, can only be expected to accomplish a limited amount of good, because a considerable number of the affected sheep do not show symptoms which enable them to be picked out surely.

It seems to be a fact, then, that enormous areas of unhealthy sheep pasture could be cleansed and deprived of their unprofitable character.

Until such time as a generally organised campaign against louping-ill can be set going, assuming that those sheep-farmers concerned will, as a body, co-operate, those who have infected farms and are disposed to try seriously methods of prevention and eradication are invited to put their special cases before the Veterinary Laboratory of the Board of Agriculture, New Haw, Weybridge, Surrey, for discussion.

AN EXPERIMENT IN THE REARING OF CALVES ON WHEY AND MEALS.

OWING to the lack of separated milk the rearing of calves on the cheese-making farm presents greater difficulties than is the case on the butter-making farm. The only by-product arising from cheese-making is the whey, which is commonly regarded as too deficient in nutritive matters, especially albuminoids, to serve as a satisfactory basis for calf-rearing, and is consequently usually given to pigs.

Whey has, indeed, been used for calves to some extent in cheese-making districts, either as a drink for calves on grass or, as in some parts of Cheshire, in the form of the "fleetings" which rise to the surface when the whey is heated (*cf.* Leaflet No. 142 or Food Production Leaflet No. 14). Very little published information on the subject is available, however, and it was thought desirable, therefore, in view of the considerable extension of cheese-making during the past two years, that further experimental work should be carried out without delay. Arrangements were accordingly made by the Board of Agriculture and Fisheries in the spring of 1918 for a comprehensive test to be made, the results of which are summarised in the

present Report. The Board are specially indebted to the authorities of University College, Reading, for the facilities provided for the experiment, and to Mr. S. Pennington, F.R.C.V.S., whose expert supervision contributed so materially to its success.

In deciding upon the supplementary foods to be fed along with the whey, consideration was given primarily to the differences in composition between whole milk and whey which, on the average, may be taken to be as indicated below :—

	Composition of One Gallon.	
	Whole Milk.	Whey.
	lb.	lb.
Water	9'00	9'55
Fat	'40	'04
Albuminoids	'35	'09
Sugar	'49	'52
Mineral salts (ash)	'08	'07

It will be seen from these figures that, compared with whole milk, whey is chiefly deficient in fat and albuminoids, and that, in order to bring up the feeding value of 1 gal. of whey to that of 1 gal. of whole milk, an addition of '36 lb. (say $\frac{1}{3}$ lb.) of fat (or oil) and '26 lb. (say $\frac{1}{4}$ lb.) of albuminoids is necessary.

The deficiency of the whey in mineral salts (or ash), though apparently trivial in amount, is nevertheless important, since it falls mainly upon the phosphate of lime, which is so important for bone formation.

The ideal "cheese substitute" for use along with whey would thus appear to be a material or mixture rich in oil, albuminoids and phosphates. The material must be concentrated and highly digestible in order that too great a bulk of it may not be necessary to supply the requisite amounts of oil and albuminoids. In devising the mixtures for these experiments, the aim kept in view was to obtain a mixture such that 1 lb. added to 1 gal. of whey would give a food approximately equal in nutritive value to that of 1 gal. of whole milk. In selecting the materials for the mixture, attention was confined to those which might be regarded as generally available for calf-rearing purposes, only one material (cod-liver meal) that could not be so described being for a time included in the tests.

Of single feeding-stuffs that approximate closely to the requirements outlined above, only one is generally available, viz., linseed, 1 lb. of which supplies 0.35 lb. of oil and 0.23 lb. of albuminoids.

A second material to which attention was directed as likely to be useful was cod-liver meal, the dried residue from the manufacture of high-quality cod-liver oil. An analysis of this material showed no less than 44.1 per cent. of oil and 36.5 per cent. of albuminoids, so that, although supplies of the meal would not warrant any recommendation of its general use, it was thought desirable that, in view of the known virtues of cod-liver oil, some test of its merits for calf-rearing should be made.

Apart from these materials it did not appear practicable to supply the whole deficiency of oil ($\frac{1}{4}$ lb.) in the form of oil, and consequently for other "cheese substitutes" recourse was had to mixtures which would supply the deficiency partly in the form of oil and partly in the form of starch or other carbohydrates. If the nutritive values of the milk and whey be expressed in terms of the equivalent weights of starch, the deficiency in nutritive value of 1 gal. of whey as compared with 1 gal. of milk is equivalent to practically 1 lb. starch. Hence these mixtures were so devised that 1 lb. would supply roughly $\frac{1}{4}$ lb. albuminoids and 1 lb. starch equivalent, the latter requirement necessitating the inclusion in each case of a proportion of material rich in oil (linseed).

In order to ensure an adequate supply of phosphate of lime, and at the same time to counteract partly any possible detrimental tendency of the acidity of the whey, it was decided to add to the ration in every case a small quantity of precipitated bone flour.

The "cheese substitutes" eventually decided upon for test were as follows:—

1.	Cod-liver meal.	5.	Cod-liver meal, 3 parts.
2.	Fish meal, 1 part.		Fish meal, 1 part.
	Linseed meal, 2 parts.		Oatmeal, 3 parts.
3.	Coconut meal, 1 part.	6.	Linseed meal, 3 parts.
	Linseed meal, 1 part.		Linseed-cake meal, 2 parts.
4.*	Bean meal, 5 parts.	7.	Cod-liver meal, 3 parts.
	Linseed-cake meal, 4 parts.		Bean meal, 3 parts.
			Fish meal, 1 part.

* Mixture as used with good results (fed with water) in experiments at the Midland Agricultural and Dairy College.

It was thought desirable, before proceeding to the experiment proper, that some information should be obtained as to the dietetic properties and general suitability of these mixtures, with a view to the elimination or modification of any that might prove unsuitable. For the purpose of this preliminary qualitative trial 8 calves, each a few days old, were obtained on 16th-19th March, 1918, and, after about a fortnight's feeding with whole milk were put on diets of whey and the above mixtures, one calf being used for each mixture. The eighth calf was given Mixture No. 4 fed along with scalded whey. The substitution of whey for milk was in all cases effected gradually in the course of fourteen days, at the end of which time each calf was receiving daily 1 gal. of whey and 1 lb. of the meal. With the one exception indicated, the whey was warmed simply to about blood-heat for feeding. Whey was received from the dairy every evening, and the acidity of each consignment was determined before feeding throughout the experiment. Apart from a few hot periods the acidity of the whey as received was usually from $1\frac{1}{2}$ to $2\frac{1}{2}$ degrees, rising to $3\frac{1}{2}$ to 5 degrees by the following morning.

In addition to the meal mixture, each calf received daily about $\frac{1}{2}$ oz. of precipitated bone phosphate stirred into the whey. Occasional cases of "blowing" were successfully dealt with by adding a little precipitated chalk to the whey. The meals were at first mixed with the whey, but as it was found on trial that the calves quickly became accustomed to consuming them in the dry form, this mode of feeding was subsequently adopted. Mixture No. 2 proved exceptional in this respect, and was only consumed satisfactorily when fed along with the whey.

It was soon found that Meal No. 1 (cod-liver meal alone) was quite unpalatable to the calf, and therefore after a few days its use was abandoned and a new mixture (No. 8) of cod-liver meal (3 parts), fish meal (1 part), and finely-ground oats (3 parts) was substituted. This mixture differs from No. 5 only in that ground whole oats replace oatmeal.

Contrary to expectations no digestive trouble was experienced with any of the mixtures, so that after a fortnight's trial on the full whey and meal diet it was thought safe to proceed to experiment on a more extensive scale.

Accordingly, on 2nd May, the calves, then about 7 weeks old, were divided into two lots of four, one lot (Lot I.) being subsequently fed on Mixture No. 6, and the other lot (Lot II.)

on Mixture No. 7, modified by substituting linseed meal for cod-liver meal.*

It will be noted that the individual calves in these lots had not been similarly treated in the preceding period, but their progress had been so uniform that no serious exception could be taken to their being grouped as indicated.

On the same day 16 new heifer calves were obtained, each about 3 days old. These were fed on whole milk until they had attained an average of 2 weeks, and were then grouped into 4 lots, of as nearly uniform character as possible in weight and appearance. For the subsequent feeding of these lots Mixtures No. 2, 3, 4 and 8 were used.

The diets used in the experiment proper may thus be summarised :—

Older Calves.

<i>Lot I.</i>	<i>Lot II.</i>
(Mixture No. 6.)	(Mixture No. 7.)
Linseed meal, 3 parts.	Linseed meal, 3 parts.
Linseed-cake meal, 2 parts.	Bean meal, 3 parts.
	Fish meal, 1 part.

Younger Calves.

<i>Lot A.</i>	<i>Lot B.</i>
(Mixture No. 2.)	(Mixture No. 3.)
Linseed meal, 2 parts.	Linseed meal, 1 part.
Fish meal, 1 part.	Coconut meal, 1 part.
<i>Lot C.</i>	<i>Lot D.</i>
(Mixture No. 4.)	(Mixture No. 8.)
Bean meal, 5 parts.	Linseed meal, 3 parts.
Linseed-cake meal, 4 parts.	Fish meal, 1 part.
	Ground oats, 3 parts.

In each case the meals were fed at the rate of 1 lb. per gal. of whey, until towards the end of the experiment when the proportion of meal was reduced. The transition from milk to whey was made gradually, and completed in the course of a fortnight, so that by the time the calves were 4 weeks old they were entirely on the whey and meal diet. From this stage onwards hay was also placed at the disposal of the calves. A little later the feeding was supplemented by a small allowance (starting with 2 oz. and rising eventually to 8 oz.) of a mixture of linseed cake, coconut cake and maize gluten feed, this being given after the morning feed. As soon as the weather became suitable the older calves were turned out daily on grass for a few hours. The grazing, however, would not permit of the younger calves being turned out.

* The use of cod-liver meal in this mixture and in No. 5 was abandoned at this stage in view of the very small supplies.

The following summary indicates the general scheme of feeding :—

Age of Calf.	Milk per day.	Whey per day.	Meal per day.	Cake per day.	Hay.
Weeks.	Pints.	Pints.	lb.	lb.	
1, 2	8	—	—	—	—
3	7-5	1-3	$\frac{1}{2}$ - $\frac{1}{2}$	—	—
4	4-1	4-7	$\frac{1}{2}$ - $\frac{1}{2}$	—	—
5	—	8	1	—	—
6, 7	—	8	1	$\frac{1}{2}$ - $\frac{1}{2}$	<i>ad lib.</i>
8, 9	—	9-12	1-1 $\frac{1}{2}$	$\frac{1}{2}$	"
10-12	—	12	1 $\frac{1}{2}$	$\frac{1}{2}$	"
13, 14	—	12	1	$\frac{1}{2}$	"
15, 16	—	8	$\frac{1}{2}$	$\frac{1}{2}$	"
17	—	8-0	$\frac{1}{2}$ -0	$\frac{1}{2}$	"
Total consumption in 112 days	gal. 18 $\frac{1}{2}$	gal. 112 $\frac{1}{2}$	lb. 86 $\frac{1}{2}$	lb. 23 $\frac{1}{2}$	lb. (say 224)
In 102 days* ..	13	111 $\frac{1}{2}$	85 $\frac{1}{2}$	21 $\frac{1}{2}$	—

* Interval between first and last weighings.

The weight of hay consumed was only checked occasionally. At 7 weeks old it was about 2 lb., and towards the end about 4 lb. per head per day.

Older Calves.

No. of Calf	Initial Weight May 8/18. (Calves about 7 weeks old.)	Final Weight July 15/18. (Calves about 17 weeks old.)	Total Increase per Head in 10 Weeks.†	Average Weekly In- crease per Head.
Lot I. { Linseed Meal, 3 parts. Linseed-cake Meal, 2 parts.				
	lb.	lb.	lb.	lb.
3	120.5	206	85.5	8.55
4	114	178	64	6.40
5	122.5	201	78.5	7.85
7	138.5	231	92.5	9.25
Average	123.9	204	80.1	8.01
Lot II. { Linseed Meal, 3 parts. Bean Meal, 3 parts. Fish Meal, 1 part.				
	lb.	lb.	lb.	lb.
1	120	224	104	10.40
2	120	204	84	8.40
6	125.5	221	95.5	9.55
8	111.5	200	88.5	8.85
Average	119.25	212.25	93	9.30

† The precise interval between the initial and final weighings was 67 days.



Lor A —Fed on Whey, Linseed Meal, and Fish Meal Mixture



Lot B — Field No. Wiley Linsed Meal and Coconut Meal Mixture



Lot C Feed on Wheat Bran Meal and Linseed Cake Meal Mixture.



Lor D. - Fed on Whey, Lensed Meal, Fish Meal and Ground Oats Mixture.

Younger Calves.

No. of Calf.	Initial Weight May 8/18. (Calves about 2 weeks old.)	Final Weight Aug. 19/18. (Calves about 17 weeks old.)	Total Increase per Head in 15 Weeks.*	Average Weekly Increase per Head.	
				Whole Period.	Last 10 Weeks
Lot A { Linseed Meal, 2 parts. Fish Meal, 1 part.					
	lb.	lb.	lb.	lb.	lb.
1	90	176.5	86.5	5.77	6.15
5	101.5	205.5	104	6.93	7.55
8	84	179.5	95.5	6.37	7.35
16	105	201.5	96.5	6.43	7.25
Average	95.1	190.7	95.6	6.37	7.07
Lot B { Linseed Meal, 1 part. Coconut Meal, 1 part.					
	lb.	lb.	lb.	lb.	lb.
2	103	220.5	117.5	7.83	8.25
10	90	189.5	99.5	6.63	7.30
14	99	187.5	88.5	5.90	6.65
15	90	185.5	95.5	6.37	7.45
Average	95.5	195.75	100.25	6.68	7.41
Lot C { Bean Meal, 5 parts. Linseed-cake Meal, 4 parts.					
	lb.	lb.	lb.	lb.	lb.
6	98	204	106	7.07	7.95
9	106	219.5	113.5	7.57	8.65
11	92	189.5	97.5	6.50	7.40
12	90	195.5	105.5	7.03	8.05
Average	96.5	202.1	105.6	7.04	8.01
Lot D { Linseed Meal, 3 parts. Ground Oats, 3 parts. Fish Meal, 1 part.					
	lb.	lb.	lb.	lb.	lb.
3	107	191.5	84.5	5.63	6.55
4	93	183.5	90.5	6.03	7.50
7	97.5	219	121.5	8.10	9.75
13	88	157	69	4.60	5.55
Average	96.4	187.8	91.4	6.09	7.34

* The precise interval between the initial and final weighings was 102 days.

Throughout the experiment, apart from occasional cases of "blowing" in the earlier stages, no trouble was experienced in securing satisfactory food consumption, and all the calves showed by appearance and weight records a healthy condition of growth.

From the time of the arrival of the younger calves, each animal was weighed separately every week. The changes in weight are summarised in the tables on pp. 44 and 45.

In order to facilitate comparison with the records of the older calves, the average weekly gains of the younger calves have been given for the last ten weeks as well as for the whole period. No stress should be laid, however, upon the apparent superiority of the results with the older calves, since these calves enjoyed the benefit of grazing and, moreover, their rearing was completed before the hot weather supervened, which proved very trying to the younger calves.

Taking the two sets of comparisons separately, and starting with the older calves, Lot II. shows a clear superiority over Lot I. It was, indeed, evident throughout the test that the linseed and linseed cake mixture fed to Lot I. was not entirely to the liking of the calves, and, although a reasonably good rate of increase was obtained, this mixture cannot be strongly recommended.

In the case of the four lots of younger calves, the best results in every way were obtained with Lot C, and in view of the similarly favourable experience in earlier calf-rearing experiments at the Midland Agricultural and Dairy College with the same mixture of bean meal and linseed cake, it is clear that this mixture is well suited for calf-rearing purposes where whole milk or separated milk is not available.

The lowest rate of increase over the whole period is shown by Lot D, although on the average of the last ten weeks it comes out rather better than Lot A. If the individual records in the two lots be examined, however, it will be noted that Lot D shows great individual variations, so that the average for this lot is less trustworthy as an index of the general merits of the feeding than in the case of the other lots. Between Lots A and B there is very little to choose.

On a broad survey of the whole results the experiment demonstrates that so far as the progress of the calves is concerned, any one of the mixtures can be used with fairly satisfactory results along with whey, but that the bean meal mixtures (Lot II. and Lot C) are probably rather better than the

rest The general order of merit would seem to be roughly as follows :—

- Lot II.—(Linseed, bean meal, fish meal.)
 „ C.—(Linseed cake, bean meal.)
 „ I.—(Linseed, linseed cake.)
 „ B.—(Linseed, coconut meal.)
 „ A.—(Linseed, fish meal.)
 „ D.—(Linseed, oats, fish meal.)

COST OF FEEDING.—The average cost of the purchased feeding stuffs used was as follows :—

	Per cwt.		..	Per lb.
	s.	d.		d.
Linseed	69	4	..	7.43
Linseed cake	31	7	..	3.38
Bean meal	44	6	..	4.77
Fish meal	27	0	..	2.89
Coconut meal	26	10	..	2.88
Ground oats	28	0	..	3.00
Mixed cake	19	2	..	2.05
Precipitated bone flour	27	2	..	2.91

The cost of the hay may be taken at 5s. 6d. per cwt. (=0.59d. per lb.), of the whole milk at 1s. per gal., and of the whey at 1d. per gal. The costs of the purchased foods were relatively high owing to the small quantities required. The cost of feeding thus works out higher than would frequently be the case in farm practice where larger consignments could be taken.

On the basis of the foregoing prices the costs per lb. of the various mixtures used were as follows :—

	d.
Mixture No. 2 (Lot A)	5.91
„ „ 3 („ B)	5.15
„ „ 4 („ C)	4.15
„ „ 6 („ I)	5.81
„ „ 7 („ II)	5.64
„ „ 8 („ D)	4.88

The relative cheapness of Mixture No. 4 was due to the fact that it was the only mixture in which linseed meal was not included. The fact that the calves did best on this, the cheapest meal, is thus doubly significant as to the merits of this mixture.

As the older calves were used for the preliminary experiment it is not possible to give an accurate record of the cost of feeding Lots I. and II. For the younger calves the total costs of feeding for 16 weeks were as follows :—

Cost of Food per Head for 16 Weeks.

—	Total Quantity.	Lot A.	Lot B.	Lot C.	Lot D.
		s. d.	s. d.	s. d.	s. d.
Whole milk ..	18½ gal.	18 3	18 3	18 3	18 3
Whey ..	112½ „	9 4	9 4	9 4	9 4
Meal mixture	86½ lb.	42 6	37 0	29 10	35 1
" Cake " ..	23½ „	4 0	4 0	4 0	4 0
Hay ..	224 „	11 0	11 0	11 0	11 0
Phosphate ..	3 „	0 9	0 9	0 9	0 9
TOTAL COST FOR 16 WEEKS		85 10	80 4	73 2	78 5
AVERAGE COST PER WEEK		5 4½	5 0½	4 7	4 10½

The cost of food for Lots I. and II. would be practically identical with that for Lot A. The extreme difference in the cost of feeding for 16 weeks is indicated as 12s. 8d. per calf, or 9½d. per calf per week.

It is of interest to compare the cost of food with the gain in live weight recorded, as set out in the following table :—

—	Cost of Food per Head for 102 days.*	Gain in Weight (average per Head) in 102 days.	Cost of Food per 1 lb. Gain in Live Weight.
	s. d.	lb. †	d.
Lot A	78 10	95·6	9·9
" B	73 5	100·25	8·8
" C	66 3	105·6	7·5
" D	73 1	91·4	9·6

The exact period between the initial and final weighings.

On this showing the feeding of Lot A (Mixture No. 2) was the most expensive relatively to the rate of growth produced, whilst the feeding of Lot C (Mixture No. 4) was decidedly the cheapest.

In order to form an estimate of the total cost of rearing it is necessary to add to the cost of the food the cost of litter and labour and the rent of the calf-house. In this experiment the cost of litter (wheat straw and peat moss) averaged 7d. per calf per week. The cost of labour and rent was higher than would be the case under ordinary farm conditions owing to the necessity of engaging a special attendant and hiring separate premises for the purposes of the experiment. It will be fairer, therefore, to assume average costs rather than the actual costs

under these heads. Labour may be assessed at 1s. per calf per week and rent at 3d. per calf per week. The three items together amount to 1s. 10d. per head per week, which, when added to the cost of food per head per week given above, give the following as the costs of rearing of the four lots :—

				<i>Per Head per Week.</i>		<i>Per Head for 16 Weeks.</i>			
				<i>s.</i>	<i>d.</i>				
Lot A	..	..	..	7	2½	..	5	15	4
„ B	..	..	..	6	10¼	..	5	9	8
„ C	..	..	..	6	5	..	5	2	8
„ D	..	..	..	6	8½	..	5	7	8

These costs may be regarded as moderate for the summer of 1918 and the experiment may, therefore, be regarded as successful from every point of view. At the close of the experiment the calves were taken over by neighbouring farmers and their further progress is being supervised.

Practical Summary. — The results of this experiment justify the laying down of the following practical directions for those who wish to rear calves on whey and meals.

1. Any of the following meal mixtures may be selected for use :—

I.		II.	
Linseed meal, 3 parts.		Linseed meal, 3 parts.	
Linseed-cake meal,		Bean meal, 3 parts.	
2 parts.		Fish meal, 1 part.	
A.		B.	
Linseed meal, 2 parts.		Linseed meal, 1 part.	
Fish meal, 1 part.		Coconut meal, 1 part.	
C.		D.	
Bean meal, 5 parts.		Linseed meal, 3 parts.	
Linseed-cake meal,		Fish meal, 1 part.	
4 parts.		Ground oats, 3 parts.	

Of the above mixtures the experiment indicated that a slight preference is to be attached to the bean meal mixtures (II. and C.).

2. The meal mixture should be used at the rate of 1 lb. to each gal. of whey, which should be warmed to blood heat.

3. Half an ounce of precipitated bone phosphate should be added to each gal. of whey.

4. From the age of four weeks the calves should be given hay *ad lib.*, and, as soon as they will eat it, linseed cake or a mixture of linseed cake, coconut cake and gluten feed, starting with 2 oz., and rising eventually to 8 oz. per head.

5. The system of feeding should be as follows :—

<i>Age.</i>	<i>Feeding.</i>
(a) Birth to 2 weeks..	Colostrum followed by new milk.
(b) 2 to 4 weeks ..	At two weeks commence substituting whey and meals (prepared as directed under 2 and 3 above) for milk. Daily increase the amount of the substitute and decrease the milk given until at the age of four weeks the calf is getting 1 gal. of whey, 1 lb. of meal, and no milk. At the outset the meal should be mixed with whey, but as soon as the calves will eat it in the dry form, they should be allowed to do so and the warmed whey containing the precipitated bone phosphate given as a plain drink.
(c) 4 to 5 weeks ..	Continue to feed 1 gal. of whey and 1 lb. of the meal daily and allow, in addition, from this time forward, as much hay as the calf will eat.
(d) 6 to 7 weeks ..	Increase above ration by starting to feed linseed cake or a mixture of linseed cake, coconut cake, maize gluten feed at the rate of 2 oz. per day, given after morning feed, gradually increasing the amount up to 6 oz. per head per day.
(e) 8 to 9 weeks ..	Increase the daily feed of whey to $1\frac{1}{2}$ gal. and the weight of the meal mixture to $1\frac{1}{2}$ lb.
(f) 10 to 12 weeks ..	During this period the calves remain on full ration.
(g) 13 to 14 weeks ..	Reduce the meal mixture gradually from $1\frac{1}{2}$ to 1 lb. per day, while maintaining the full supply of other foods.
(h) 15 to 16 weeks ..	Reduce the whey to 1 gal. and the meal mixture to $\frac{1}{2}$ lb. per day. The calves now get— 1 gal. whey, $\frac{1}{2}$ lb. meal mixture, 6 oz. cake (or cake mixture). Hay, <i>ad lib.</i>
(i) 17 weeks ..	If the calves can be put out to grass, or if a supply of succulent farm foods is available, the whey and meal mixture may be discontinued at the end of 17 weeks, but in this case the quantity of the cake allowed should be increased to $\frac{1}{2}$ lb. per head per day.

6. Should any digestive trouble in the form of “blowing” occur in the calves during the early stages of feeding whey,

it can be successfully dealt with by adding a little precipitated chalk to the whey.

(*This article is also issued separately as a Leaflet, known as A309/I. Copies may be obtained free of charge and post free on application to the Secretary, Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1. Letters of application so addressed need not be stamped.*)

THE HISTORY AND VALUE OF LATE-FLOWERING RED CLOVER OR SINGLECUT COWGRASS.

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THE results which have been obtained from late-flowering red clover on clover-sick land are so striking and valuable that it is worth while to inquire how this variety of red clover has originated and to summarise the comparative results of it and of ordinary red clover.

History of Introduction and Growth of Red Clover in England.—

In Stephenson's "Agriculture of Surrey," 1809, a very complete account is given of the introduction of red clover into England. In that work it is stated on the authority of Aubrey's "History of Surrey" (published about 1673), that Sir Richard Weston introduced red or great clover from Flanders or Brabant about 1645, and that he grew it at Sutton, Surrey. In Worlidge's book, "*Systema Agriculturæ*," 1669, this clover grass is described with enthusiasm:—"One acre of this grass will feed you as many cows as six acres of other common grass." It should be noted that at that time all sown grasses or clovers were called "artificial" grasses, to distinguish them from plants that came naturally in the herbage. In Stephenson's book a quotation is given from the Communications to the old Board of Agriculture, 1805, by Mr. Morris Birkbeck, as follows:—"We are already in possession of the seeds of several plants of great value in the formation of perennial turf, viz., ray-grass (*Lolium perenne*), perennial clover or marsh grass (*Trifolium pratense*), Dutch clover (*Trifolium repens*), ribgrass, and *Holcus lanatus*." Stephenson mentions that 10 lb. of perennial red clover and one qr. of hay loft seeds (per acre?) were sown with barley. In the Communications to the Board of Agriculture, 1805, the Rev. George Swayne,

Bristol, recommends for pasture or for hay, meadow foxtail, ray-grass (either Peacey's or that collected in old grass leys), meadow fescue, hard fescue, tall oat grass, and cowgrass, otherwise called cow clover, honeysuckle trefoil, or *Trifolium pratense*, the native variety. This indicates that the seeds of wild white and wild red clover were collected and used, as well as that of the cultivated red clover. In Arthur Young's "Agriculture of Lincolnshire," 1813, the following occurs:—"Mr. Parkinson finds that his land will not produce red clover in a four years' course more than two rounds; he then changes to 1 bush. ray-grass, 6 lb. trefoil and 6 lb. red clover for one round; and the next round 8 lb. cowgrass and 6 lb. Dutch clover; cowgrass yields a wonderful burthen, 9 in. higher than red clover, but the red yields the best eddish (aftermath); it will last two or three years, but better to plough sooner." In Pitts' Agriculture of Worcestershire," 1813, it is stated that clover seed was grown extensively in that county, and that Worcester was a great market for the seed; also that many of the old pastures contained ray-grass, white clover and meadow clover (*Trifolium pratense*). In Boy's "Agriculture of Kent," 1805, it is mentioned that the common red clover, the sort called cowgrass, and the white are the only sorts cultivated in Kent, and that a crop of clover seed was usually from 2 to 4 bush. an acre. It is also recorded that cowgrass was a species of clover which was mown only once in a summer (singlecut cowgrass) and that this plant is perennial. In Lawrence's "New Farmers' Calendar," 1809, the following seeds mixture per acre is taken from Curtis, author of the "*Flora Londinensis*":—"Meadow foxtail and meadow fescue, each one pint; smooth- and rough-stalked meadow, each half-a-pint; crested dog's-tail and sweet-scented vernal, each one quarter of a pint; Dutch clover, wild red clover (*Trifolium pratense*), or broad clover of the shops, half-a-pint." Lawrence also states that cowgrass or perennial red clover differs from the common red clover in little else than the solidity of the stalks, and that several persons complained of being unable to secure the genuine seed. In Young's "Annals of Agriculture," Vol. 3, 1785, the Rev. Mr. Onley, Essex, wrote that he turned his cows in late spring into his wild meadow clover, vulgarly called cowgrass. "My trial of this grass seems fully to answer. I sowed 10 lb. per acre at 6d. per lb. In a poor crop of oats I found a most luxuriant plant of this clover which has afforded a great autumn feed; and the butter was most excellent. . . . Though perennial, I shall next year plough in the ley, like that of usual clover for wheat." There are many other references about this time

to different kinds of red clover, and there was evidently much doubt as to whether cowgrass clover was a variety of red clover or was zig-zag clover (*Trifolium medium*). Sinclair, in his book on Grasses, 1825, describes *Trifolium medium* as marl clover or cowgrass, but Lawson in his Agricultural Manual, 1836, describes (1) native perennial red clover, (2) common cultivated perennial red clover or cowgrass, which is a few days later in coming into flower, and differs from common red clover only in having rather more woolly leaves and in being of more permanent duration, (3) Duke of Norfolk's cowgrass, a variety more permanent than the last, and which flowered earlier, (4) perennial red clover of Argovie, introduced into France from Switzerland and proved by the French to be the most perennial variety they possessed, (5) perennial red clover of Germany, which resembled the last, but was rather later in flowering. He then describes the common or English red clover, and, further on, *Trifolium medium*, the zig-zag clover or marl grass, as being sometimes termed cowgrass, but states that it can only be considered as a pestiferous weed. Undoubtedly Lawson was a better authority on this subject than Sinclair, and it may, therefore, be accepted that in 1836 the name cowgrass was generally given to the variety of red clover which he describes above, and not to marl or zig-zag clover.

It seems clear from the foregoing that common red clover and the kind now called late-flowering red clover or singlecut clover or cowgrass, have both been grown as cultivated clovers in England for about the same time, and, further, that a number of attempts have been made to develop native or wild red clover as a cultivated plant.

Results in Sweden.—Hernfrid Witte, in his account of red clover of different origins at Svalöf, Sweden, 1907-1912, describes wild red clover, cultivated red clover and late red or singlecut clover. He notes that wild red clover usually flowers very early, is more permanent, and is of earlier growth than the cultivated types. In most parts of Sweden the late red clover is the only type that can be grown with advantage. Swedish late red clover has later and earlier strains, and the earlier strains sometimes flower quite as early as the later strains of early red. Witte states that early and late red clovers have long been grown in Sweden. He is of opinion that both strains were imported in the beginning of the nineteenth century, and that the types have been kept distinct. The tables giving the results of the trials show that the earlier strains have generally given the best aftermaths, while the

later strains have not only given the heaviest first crops of clover, but also the largest yields when the two cuttings of the season were taken together. He summarises the average yields of different types of Swedish clovers from four trials, each conducted over two years at Svalöf.

TABLE I.—*Summary of Svalöf Results.*

	<i>Green Clover per Acre.</i>		<i>Two Years' Total.</i>
	<i>First Year.</i>	<i>Second Year.</i>	
	tons	tons.	tons.
Swedish late red clover ..	13½	9½	23½
Swedish medium red clover ..	13½	9	22½
Swedish early red clover ..	11½	8	19½

These results include two cuttings for each year, and show that in the two years Swedish early red gave about 16 per cent. less weight of clover than the Swedish late red, and also that the late red increased its advantage over early red in the second year.

Results at Cockle Park.—The following results at Cockle Park, the Northumberland County Agricultural Experiment Station, confirm those obtained at Svalöf.

TABLE II.—*One Year's Ley: Weights of Hay per Acre.*

	1913.	1915.	1916.	1917.	Average.
	cwt.	cwt.	cwt.	cwt.	cwt.
Ordinary red clover ..	39½	26½	49½	32½	37½
Late-flowering red clover	61½	25	69½	40½	49

These results are strikingly in favour of late-flowering red clover. Ordinary red clover usually suffers from clover sickness at Cockle Park, and the good results from late red are likely to be partly due to its standing better against this disease. The aftermaths, which are not taken into account in the table, have always been much more valuable from the late-flowering red clover.* The seeds mixtures contained in each case the same quantities of these clovers, varying from 4 to 6 lb. per acre.

TABLE III.—*Three Years' Ley: Average Annual Weights of Hay per Acre.*

	1912-14.	1913-15.	1915-17.	Average.
	cwt.	cwt.	cwt.	cwt.
Ordinary red clover ..	40½	35	30	35
Late-flowering red clover	42½	44½	35	40½

Three Years' Ley: Weights of Hay per Acre in First Year.

	1912.	1913.	1915.	1916.	1917.	Average.
	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
Ordinary red clover ..	36½	39½	29	52½	33½	38
Late-flowering red clover	36	52	32	56	34	42

The results shown in Table III. are also strongly in favour of late-flowering red clover. The last figures show a considerable

* This is somewhat contrary to usual results, ordinary red clover as a rule giving a greater weight of aftermath.

advantage for late-flowering red clover in the first of 3 years, and the first figures show that this advantage is more than maintained in the second and third years.

The seeds mixtures in every case contained 4 lb. of these respective clover seeds. Not only has late-flowering red clover given the heaviest crops of hay, but the aftermaths have invariably been of a much more satisfactory character. Ordinary red clover produces a heavier aftermath in the first year, but there is little of this clover left in the second and third years. Late-flowering red clover is about 10 days later in flowering than ordinary red clover, and gives aftermaths that are better suited for grazing than for mowing because the herbage is of a leafy, rather than of a stemmy, character. Quite a fair proportion of plants of this clover remains till the third year, thus showing it to be of longer duration. Wild white clover is always included in the seeds mixtures for three years at Cockle Park. This provides abundant herbage in the second and third years' hay and aftermath. If it were not for this clover, the results in the last two years would be much more in favour of late flowering red clover. It should be stated that in practically all cases English seed was obtained of both clovers, trials at Cockle Park having distinctly indicated that English seed is likely to produce plants of a more lasting character and to give the most satisfactory crops.

Conclusions.—Strains can now be obtained from seedsmen of ordinary red clover and singlecut or late-flowering red clovers. It is of the greatest importance that more attention should be given to the increased production of the most valuable strains of these clover seeds. Late-flowering red clovers produce seed more sparingly than ordinary red clovers. Every endeavour should be made to produce the seed of this valuable late-flowering red clover in very much greater quantity than hitherto, and every care should be taken in the selection of the seed for growing crops from which seed is to be produced. The present Seed-testing Order of the Board of Agriculture gives no help in this direction, as true strains of late-flowering red clover seed cannot be verified by the examination of the seed. The producers of true and reliable seed of late-flowering red clover can confer a very great benefit indeed on the agriculture of this country by selecting the very best stocks of seed they can obtain and by increasing the areas grown of this seed. It has long been known that English grown clover seeds are likely to give the most satisfactory results.

CONTROL OF THE WEEDS WHITLOW PEPPERWORT AND BLACK MUSTARD.

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WHITLOW PEPPERWORT (*Lepidium Draba*).

Lepidium Draba (commonly called Whitlow Pepperwort; Hoary Cress, or "Whiteweed") is, according to Bentham, "rare in Britain, and only as an introduced plant in a few English counties." It is common in central and southern Europe and in temperate Russian Asia.

Characters.—A perennial plant, about 1 ft. high, more or less covered with a minute down. Stems stout, erect, branching above.

Leaves oblong or broadly lanceolate, usually slightly toothed, 1½ to 2 in. long, the lower ones stalked, the upper ones clasping the stem with projecting auricles.

Racemes not much lengthened, forming a broad, flat corymb.

Pods about 2 lines broad and not quite so long, very thick, the valves sharply keeled, but not winged, the style prominent.

In cultivated fields in Essex it attains a height of 2 ft., and Hayward in his "Botanist's Pocket Book" gives its stature as 1 to 2 ft.

Mr. Edwin E. Turner, the doyen of Essex field botanists, who has made a lifelong study of the Essex flora, writes* as follows :

Lepidium Draba (Linn.)—"This plant was introduced in 1809, by the troops returning from the ill-fated expedition to the Walcheren. These landed on the Isle of Thanet on the mouth of the Thames, and when the stores, fodder, etc., were unloaded, it is said that seeds of *L. Draba* were included.

By various agencies the plant has since spread over Kent and Essex, and it has been recorded in other places in the Midlands. To the farmer it is no doubt a pest, and the late F. A. Fitch, of Maldon, told me that it came to his farm in clover seed, and although he tried every means to eradicate it, even employing women to hand pick it, he failed in the struggle. The long cord roots were found in the deepest drains, over a yard in depth, and the large quantities of seeds matured were washed down the ditches and so distributed over most of the land.

It first came to my notice over thirty years ago, being sent from Battlesbridge, Rettendon, by a gentleman, accompanied by a letter in which he stated that a new weed had appeared in the cultivated land of his district. It then came under my notice in a field belonging to Elm Hall, on the Cressing Road at Witham, since which it has turned up in many localities, even on Mersea Island. Also, it came up in plenty some years ago in a spot where

* Letter to the writer, dated 29th July, 1918.



FIG. 1 --*Lepidium draba*, Seeding Stage (natural size).

A.—Seed Pod, slightly concave side ($\times 1\frac{1}{2}$).

C.—Three quarters front ($\times 1\frac{1}{2}$).

B.— " " " convex " "

D.—Seen from underneath ($\times 2\frac{1}{2}$)

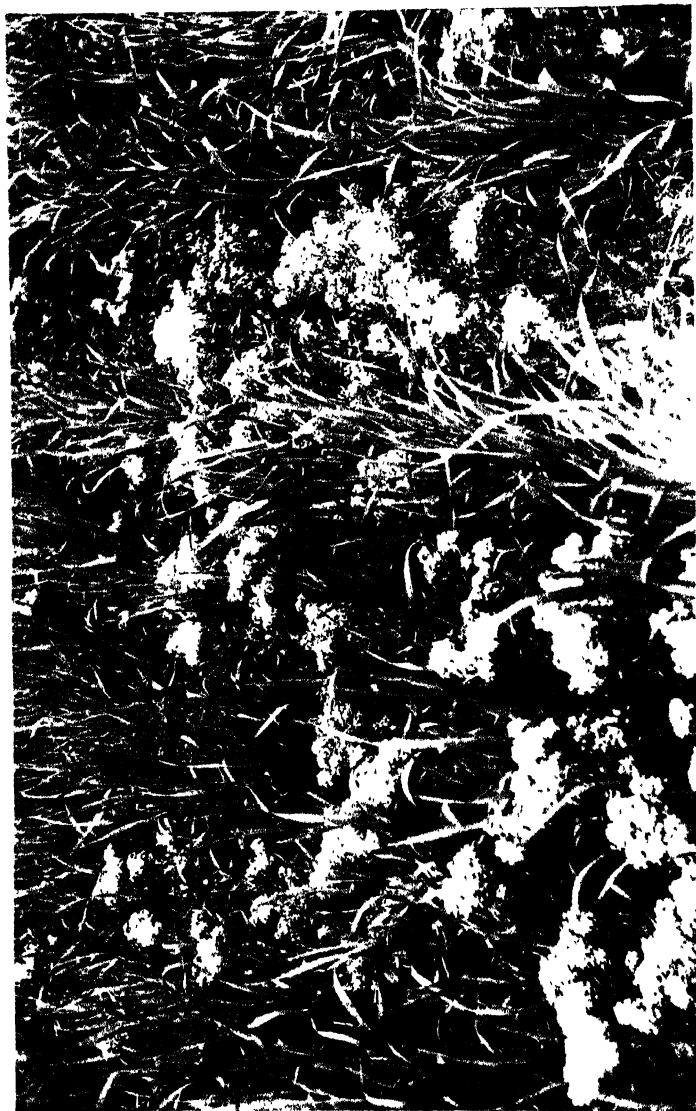


FIG. 2.—Showing an unsprayed area with the weed *Lepidium draba* as the predominant plant



FIG. 3.—Oats and *Lepidium draba* sprayed with Copper Sulphate 3 per cent., and Sodium Nitrate 5 per cent.—80 gal. of spray fluid per acre



FIG. 4.—The Plot enclosed within the lines was sprayed with Copper Sulphate .2 per cent . and Ammonium Sulphate .5 per cent .—70 gal. per acre. The remainder of the field was untreated.

sheep washing had been done on the borders of the lake at Rivenhall Place, and may have been brought there in the fleeces after the flock was fed in a clover field."

The Land Affected.—This weed is prevalent on the east of Essex, especially around Southend, Maldon Estuary, and in the Witham district. It has been established for many years and has survived all the efforts made by farmers to eradicate it. It is to be found on stiff London clay soil as well as on the lighter lands of the coast.

It can maintain its existence amongst grass and lucerne, and it grows luxuriantly in many ditches and in waste heaps by the wayside. When the ground is cultivated for corn, etc., it grows vigorously. Above ground it is as bad as charlock, below ground it is as bad as bindweed.

Mechanical Treatment of Infected Areas.—Treatment which is effective against couch grass is of no avail in this case. The rootstocks penetrate to a considerable depth, some having been traced down to a depth of 4 ft. Mr. John Steel, of Rochford, has had one portion of a field hand-weeded for 18 years, and though he has by this means kept it to the original area of infection, yet it still continues to grow. It flowers in June and seeds in July, and if it be allowed to seed the degree of infection is, of course, increased, as well as the area.

The cost of hand-pulling is considerable; perhaps 25s. per acre is a medium estimate.

Description of the Spraying Trials.—The spraying of a field in which this weed is prevalent is rather difficult from the *experimental* point of view, as one finds that the ground is more or less patchy, whilst between the patches the number of plants is comparatively small. In 1917 in a field beside Southend, selected by Mr. Alec. Steel, a charlock spray was put on a patch of *Lepidium*. The plants were in flower and the corn about knee height. The results were encouraging, for a week later the leaves were dead, the flowers had produced no seed, and altogether the effects were comparable with those on charlock in flower. The underground parts, however, were still alive.

In 1918, a field of oats belonging to Mr. E. Ockleston, of Woodham Ferrers, was selected for further trials of sprays. On 11th May, 1918, about half of the field at Woodham Ferrers was sprayed with 4 per cent. copper sulphate at the rate of 40 gal. to the acre, and two bad patches were treated with 80 gal. per acre of the same spray.

In the following weeks the effects were so marked and so encouraging that Mr. Ockleston wished to have it all done a second time with the same spray. This could not be done, however, till 29th and 30th May, when ten plots were sprayed with various sprays. These plots were, on the average, about a square chain in area, and represented those portions of the field where *Lepidium* was the predominant plant (see Fig. 2). These plots were sprayed with knapsack sprayers, and it took two people two days to do the work. Knapsack spraying is no good for field work, because it is too slow, but for the present purpose the knapsack answered admirably as the plots were *equally* sprayed; exact applications were possible. On 12th June, when the photographs shown in Figs. 2, 3 and 4 were taken, all the plots were easily visible from the road, as the field sloped upwards from it, and appeared as dirty-green, square, or oblong patches. On walking to these patches one found that this dirty appearance—as contrasted with the bright green of the unsprayed oats—was due to the brown colour of the dead pepperwort. The leaves of the oats which had suffered from the spray were not visible from a distance, as they were obscured by the fresh green leaves above and by the dead leaves of the pepperwort.

TABLE I.—*Summary of Sprays applied to Ten Plots on a Field of Oats containing Pepperwort Weed.*

Plot.	Ammonium Sulphate.		Sodium Nitrate.		Copper Sulphate.		Iron Sulphate.		Gal. per Acre.
	lb. per acre.	per cent.	lb. per acre.	per cent.	lb. per acre.	per cent.	lb. per acre.	per cent.	
1 ..	56	8	—	—	14	2	—	—	70
1A ..	56	8	—	—	14	2	—	—	70
2 ..	—	—	56	8	14	2	—	—	70
3 ..	—	—	40	3	24	5	—	—	80
4 ..	—	—	27½	1·5	16½	2·5	—	—	110
5 ..	—	—	—	—	—	—	80	10	80
6 ..	—	—	50	5	—	—	40	4	100
7 ..	—	—	—	—	32	4	—	—	80
8 ..	—	—	10	1	15	1·5	100	10	100
9 ..	—	—	10	1	20	2	20	2	100

Results.—On 9th July the field was inspected by Mr. Alec. Steel, Mr. John Steel, and Mr. Harold Rankin, who were interested in the problem, as the Rochford district is specially troubled by this weed.

On that date the plots were indistinguishable, as far as the growth of the oats was concerned, from the unsprayed part

of the field, excepting in the case of Plot 2, where the growth of oats was rather backward, but green and vigorous notwithstanding. This plot had had 80 gal. per acre of charlock spray on 11th May and 70 gal. of the combined spray, copper sulphate and nitrate of soda on 29th May. The final effect of the spray on the oats was then seen to be in no wise adverse to the oats, whilst the pepperwort had succumbed, as shown in Table II.

TABLE II.—*Effects of the Spray on the Weed and Oats on 8th June, 1918.*

Plot.	Condition of Weed.	Condition of Corn.
1	Killed	Outer leaves killed, more adverse result than 7.
1A	"	"
2	"	Outer leaves killed.
3	"	"
4	"	"
5	Leaves blackened, but plants still alive and flowering. Result unsatisfactory.	Outer leaves blackened.
6	Result unsatisfactory	A few leaves blackened.
7	Killed	Outer leaves killed.
8	Fairly well done, but not so good as 7.	Outer leaves blackened, no check to growth apparent.
9	Fair, result distinctly inferior to 1, 2, 3, and 7.	Outer leaves slightly discoloured.

The workmen found about this time that the weeds on Plot 4 had been killed to a considerable depth below the soil. That plot had received the heavy application of 110 gal. of liquid per acre.

About the end of August, seeds of the pepperwort were gathered. Each flower produces two seeds of a deep, rich brown colour. Of these seeds 486 weigh 1 gramme.

Cost per Acre.—Taking nitrate of soda at £20 a ton, sulphate of ammonia at £17 a ton, and copper sulphate at 6d. per lb., the costs per acre of the sprays used are as follows:—

Plot.	Substances used per Acre.	Cost per Acre.
		s d.
1	Copper sulphate, 14 lb. (7s.)	15 6
	Ammonium sulphate, 56 lb. (8s. 6d.)	
2	Copper sulphate, 14 lb. (7s.)	17 0
	Sodium nitrate, 56 lb. (10s.)	
3	Copper sulphate, 24 lb. (12s.)	19 2
	Sodium nitrate, 40 lb. (7s. 2d.)	
4	Copper sulphate, 16½ lb. (8s. 3d.)	13 2
	Sodium nitrate, 27½ lb. (4s. 11d.)	
7	Copper sulphate, 32 lb.	16 0

Summary.—These experiments indicate a method of controlling this weed far in advance of the mechanical methods hitherto in vogue, and it is suggested that farmers who have *Lepidium* in their fields should equip themselves with a horse-sprayer, and spray the weeds about the beginning of May. It is likely that two annual sprayings will be found necessary, and in that case the use of nitrate of soda or sulphate of ammonia along with the copper sulphate will encourage the farmer to carry out this work where the use of the copper sulphate alone might not supply sufficient inducement. The weeds in the hedges and on the edges of the ditches should be carefully attended to, as the plant seeds very freely.

The stamping out of the pest will be a big task, no doubt, because of the root system, but there is good reason to hope that with combined effort it can be done.

BLACK MUSTARD (*Sinapis nigra*).

This plant, common on the coast of Essex, is a very troublesome weed, which in its effects is comparable in most respects with charlock. Anne Pratt, in her "Flowering Plants, etc., of Great Britain," says that this plant "is commonly cultivated for the mustard of commerce, and large fields are sown for this produce in Essex and other counties. The pungent seeds consist of a mucilaginous and farinaceous substance, combined with a bland fixed oil, and a volatile or essential one, of great pungency, in which sulphur is said by Müller to exist to the amount of about 30 per cent. The acidity of this latter oil is increased if the seeds are kept some time after they are gathered, or it is at once developed by steeping the seeds in vinegar."

Professor Burnett, remarking on the tenacity of life of these seeds, says that when a crop of mustard has once been seeded, self-sown stragglers will come up for a century afterwards.

In the "Grain of Mustard Seed Parable," Sir Joseph Hooker and Dr. Tristram "contend that our *Sinapis nigra* is the species referred to, for in Palestine it attains a height of 10 ft. and may fitly be regarded as a tree among herbs, for flocks of linnets and other finches 'lodge' among its branches for the sake of its abundant seeds."

Hayward, in his "Botanist's Pocket Book," puts its height at 1 to 2 ft. It must be remarked, however, that when growing in cultivated soil it attains a height of about $4\frac{1}{2}$ to 5 ft., and the

remarks about the Palestine mustard are interesting in that they show to what size the plant can attain under the most congenial conditions.

On the islands off the coast of Essex the soil seems to be full of the seed of this plant, even where the land has been "down to grass" beyond the memory of the present inhabitants. It comes up among the wheat, oats and peas, and, in spite of hoeing, these crops about midsummer appear as a sea of yellow flowers. The hoeing of the corn certainly brings about the destruction of the weeds *between* the rows, but those that grow in the rows of corn, and they are as numerous as the corn plants, cannot be mechanically destroyed without at the same time destroying the corn crop. The result is that only about half a crop of wheat or oats is obtained on such land, for the weed competes with the corn in respect of the soil nutriment throughout the whole season. It competes with the corn in respect of light on equal terms in the beginning of the season, but in June it hopelessly smothers the crop, so that the light reaching the latter must be very imperfect. Before the corn comes into ear the mustard is "topped" to prevent a part of the seeding and to allow the light to get to the corn.

Description of the Spraying Trials.—In 1917, charlock sprays were tried on small areas infested with the weed. The results were quite satisfactory, and, in 1918, spraying with copper sulphate solution and copper sulphate, plus nitrate of soda solution, was carried out on a larger scale in a field of oats which had already been twice hand-hoed so well that not a single weed was to be found anywhere between the rows of corn. Nevertheless the field was a mass of mustard.

On the 27th May spraying was commenced in this field, about three acres being sprayed that day.

Plot.	Area.	Quantity of Spray used.	Substance Dissolved.
1	1 acre ..	40 gal. ..	Copper sulphate, 16 lb.
2	1 " ..	60 " ..	" "
3	$\frac{1}{2}$ " ..	40 " ..	" "

On the 29th May the report on the field was "the mustard is all dying and the corn is very severely hit, especially on Plot 3."

On the 1st June, three more plots were sprayed (see next page).

Plot.	Area.	Quantity of Spray Used.	Substance Dissolved.
4	1 acre ..	40 gal. ..	Copper sulphate, 8 lb. Nitrate of soda, 20 lb.
5	1/2 acre ..	40 " ..	" " " "
6	1/2 acre ..	40 " ..	Copper sulphate, 8 lb. Nitrate of soda, 12 lb.

In two days the mustard began to turn brown and dry up on these last three plots as it had done on the first three the previous week. When the second lot (4, 5 and 6) was being sprayed the corn on Plot 3 had its outer leaves brown and dead, but the young leaves were growing out vigorously from the tops. Fears had been entertained that the corn was all killed, especially on Plot 3, but at the end of a week it was seen to be alive and recovering quickly.

As far as weed killing was concerned, Plots 3, 5 and 6 were the best, and Plot 2 was nearly as good. Plots 1 and 4 were not so thoroughly done, the quantity of spray, 40 gal. per acre, not being sufficient at that time of the season to wet the leafage completely, though that quantity of spray fluid applied earlier would probably have been ample.

The plots which received 60 gal. per acre had the leafage thoroughly wetted.

At the time of spraying the leaves of the oats were getting fairly broad, and consequently got their share of spray as well as the mustard. All these broad leaves withered off.

Results.—On 21st June the field was inspected to see how the oats and the mustard had progressed. As the writer approached the field he saw a small yellow plot at the one end of the field, then a stretch of green with two narrow yellow lines dividing it into three green strips, and finally beyond this green belt was a second mass of yellow extending to the end of the cornfield. The yellow portions at the two ends were the unsprayed portions, as were also the two narrow yellow lines left in the green belt between Plots 2, 3 and 4. The mustard was at this time in full flower and was about 4 ft. 6 in. high. The men had to "top" all the unsprayed part of the field, but on the sprayed portions there was no mustard to "top," and the corn was growing well. The young leaves by this time obscured the older, lower leaves which had been killed by the spray fluids, and there was practically no evidence of the spraying that had taken place, till one looked among the oats for the dead stalks of the mustard.

No attempt was made to record the comparative yields of the treated plots because of shortage of labour. The experiment sufficed to show, however, that the charlock spray was as effective on mustard as on charlock, and that the gain in the cereal crop was very considerable. Farmers who spray against charlock know that the cereal crop receives a temporary check, but they know also that they obtain at the end of the season a full crop, or very near it.

Costs.—Taking copper sulphate at £56 per ton and nitrate of soda at £20 per ton, the costs of the treatments are as follows :—

Plot 1 ..	16 lb. copper sulphate	8s. per acre.
" 2 ..	" " " " " " " " " "	8s. "
" 3 ..	20 lb. " " " " " " " "	10s. "
" 4 ..	{ 8 lb. copper sulphate	4s. and 3s. 7d.
	{ 20 lb. nitrate of soda	=7s. 7d. per
		acre.
" 5 ..	{ 12 lb. copper sulphate	6s. and 5s. 4d.
	{ 30 lb. nitrate of soda	=11s. 4d. per
		acre.
" 6 ..	{ 12 lb. copper sulphate	6s. and 3s. 3d.
	{ 18 lb. nitrate of soda	=9s. 3d. per
		acre.

The above prices represent the cost of material in war time, and are about double pre-war costs. The labour cost is not great, and as an offset against the whole expense there is the saving of the hand-hoeing and weed "topping," which are necessary if the spraying be not undertaken.

The *manurial* value of the nitrate of soda has also to be reckoned, for the combined spray kills the weeds and then manures the crop.

APPLE APHIDES.

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THE so-called "Aphis" or "Blue Bug" Blight of apples, and to a minor extent of pears, is in some years one of the worst ills fruit-growers and gardeners have to contend with in this country. The terms Aphis, Dolphin or Blue Bug "Blight" are common names in all fruit-growing districts. They apply to damage done by several species of plant lice or aphides.

Out of the eight species of aphides recorded as attacking the apple in Great Britain only four are of general importance. These are : (i) the Blue Bug or Rosy Apple Aphis (*Aphis malifolia*, Fitch) ; (ii.) the Green Apple Aphis (*Aphis pomi*, De Geer) ; (iii.) the Oat Apple Aphis (*Siphocoryne avenae*, Fabr.), and the Woolly Aphis or American Blight (*Schizoneura lanigera*, Hausmann).

The following article deals only with the first three, which are leaf, blossom, shoot or fruit feeders, unlike the Woolly Aphis, which feeds on the wood and roots as a rule, but which in very bad attacks may spread also to the leaves and fruit. This latter insect is dealt with in the Board's Leaflet No. 34. By far the greatest amount of harm is done by the *Aphis malifolia*, but in some years and in certain localities the Green Apple Aphis (*Aphis pomi*) and the Oat Apple Aphis (*Siphocoryne avenae*) are of considerable importance. The life-histories of many Aphides are now well known. A definite annual migration may take place between two totally different host plants, as is seen in the case of the Hop Aphis (*Phorodon humuli*), which annually migrates from the hop, to winter on the sloe and damson, in the egg stage, and in the various 'gall-forming' Poplar Aphides (*Thecabius affinis*, etc.), which leave the poplars in summer and fly to such plants as *Ranunculus*, *Gnaphalium*, etc., and then back to winter on the poplars in the egg stage.

On the other hand there are many kinds which apparently have erratic and local migratory habits. The Apple Aphides—*Aphis malifolia*, *Aphis pomi*, and the Woolly Aphis (*Schizoneura lanigera*) come in this group, at least as far as the writer has been able to trace in this country.

The more salient features of most destructive plant lice on fruit are known, and as such alternate host plants as damsons, sloes, plantains, etc., cannot be exterminated, the matter is more of scientific than of practical importance.

Damage Caused by Apple Aphides.—The damage occasioned by the three species of apple pests mentioned below is mainly to the foliage and young wood, but also to some extent to the fruit, which they stunt and deform ; whilst one, the Oat Apple Aphis (*Siphocoryne avenae*), may damage the blossom as well as the leaves ; and in some seasons similar damage is done by the Blue Bug or Rosy Apple Aphis (*A. malifolia*). The Green Apple Aphis (*A. pomi*) mainly attacks the young shoots, and so densely do the insects cluster on them that they check the growth. They do not, however, produce such distortion as is

caused by *A. malifoliae*. The last-named, by means of the constant puncturing of the leaves by its proboscis, causes these to curl up, and beneath this shelter the lice reproduce, in certain seasons, at a great rate. The foliage becomes smothered and poisoned by their honey-dew and other excretions and turns brown; in some cases the lice produce, earlier in the year, yellow or rosy-red galled masses on the leaves. Later they may swarm on the leaf-stalks, shoots and fruitlets, and by their punctures deform them. The leaves may fall and only a few stunted and galled apples remain. The crop is now and then completely ruined by this pest and the trees have a serious set back for the next season and probably for a longer time.

The Green Apple Aphis (*A. pomi*) may on occasions produce a certain amount of leaf-curl, but never to the same disastrous extent as is caused by *A. malifoliae*. Moreover, it never occurs in such vast numbers. It mainly feeds upon the young top growths, and although producing but little deformed growth, it nevertheless checks the health of the tree, especially when on young stock.

The Oat Apple Aphis (*S. avenae*) does little harm as a rule, except where it invades the blossom trusses, in which case the writer has very often seen appreciable damage done. It produces little or no leaf curling, appears earlier, and matures and flies away much sooner than the other two kinds.

Appearance of the Species.—

A. ALATE OR WINGED VIVIPAROUS FEMALES:—

1. *A. malifoliae*.—Cornicles black, rather long. Abdomen red and black.
2. *A. pomi*.—Cornicles black, rather long. Abdomen green with black lateral spots.
3. *S. avenae*.—Cornicles pale brown to green, rather short, constricted at base and apex. Abdomen green, with black lateral spots.

B. APTEROUS OR WINGLESS VIVIPAROUS FEMALES:—

1. *A. malifoliae*.—Blue-black, slatey-grey or pink. Cornicles long, black; fat, rounded and more or less mealy.
2. *A. pomi*.—Green; not mealy. Cornicles long and black.
3. *S. avenae*.—Green, not mealy. Cornicles rather short, constricted at base and apex, brown and green.

C. OVIPAROUS FEMALES ; all APTEROUS :—

1. *A. malifoliae*.—Yellow, lemon yellow, dull greenish yellow or grey ; head dark. Cornicles pale yellow to dusky yellow, darker at tips.
2. *A. pomi*.—Green to dull yellow ; head darkened, cornicles black ; cauda black.
3. *S. avenae*.—Green, dull green, greenish-yellow or yellow ; head brownish. Cornicles short, brown to black ; constricted at base and apex ; cauda, dusky brown.

D. MAJES :—

1. *A. malifoliae*.—Winged. Abdomen, dull reddish and deep blackish-brown to brown.
2. *A. pomi*.—Apterous. Dull greenish-yellow, green or yellowish-brown.
3. *S. avenae*.—Winged. Abdomen black and dull green, with dark lateral spots.

Life-Histories.—The Blue Bug or Rosy Apple Aphis (*A. malifoliae*) passes the winter on apples and pears in the egg stage. The small, shiny, black eggs are laid singly, and are at first pale ; they hatch out during early April. The young at first live freely on the tops of the bursting buds and then enter them. As the young mature into what are spoken of as "Mother Queens," the leaves may either curl up and protect them, or the insects may remain for a short time fully exposed. These females soon produce living young with great rapidity in some seasons, and the progeny of these as they grow cause the leaf to curl up and enclose them and their parents. Owing to the constant sucking of the aphides and their excrement, the leaves become scorched, and sometimes fall off. As the insects increase in numbers they pass to the shoots and stop the growth of the internodes, and deform them, a marked "stubby" appearance being produced, even on fairly old trees.

In June and July these apterous viviparous females give rise to a winged generation of insects, which often occur in dense masses on the branches and stems, and are sluggish in habits. When very abundant they swarm all over the tree ; when less plentiful they seem to collect under the branches. Previous to the alatae appearing, the apterae also seem to wander about in a restless manner and many are caught in old grease-bands. Most of the winged dolphins die, but others undoubtedly fly away in July. Where these latter fly to in this country has not yet been traced. In America and Canada they are said

to fly to the plantains (*Plantago* spp.). None have yet been found on the plantains in this country, either above or below ground. The writer has carefully noted some thousands of these plants, pulled during the past season for rabbit food, and no trace of *A. malifoliæ* has been seen in a district where this species is very prevalent. Moreover, the writer has completely failed to get alatae of *malifoliæ* to reproduce on *Plantago*. On the other hand they have done so on the Guelder Rose (*Viburnum opulus*). The only plant louse found commonly on plantains in Britain is the green *Aphis plantaginis* of Kaltenbach, so often seen on the roots, leaves and flowers stalks; it is a species of very similar structural form but is undoubtedly distinct. The writer has failed repeatedly to cultivate this species on the apple. It is a well-known ant "attended" species.

Alate females of *malifoliæ* commence to return to the apples late in September, but the majority do so in October and even on into November. These returning migrants produce the apterous egg laying females and, so far as the writer has traced, some alate males; but some of the latter appear later, and it is probably normal that the alate males fly back from some host plant to the apples, at about which time the oviparous females are mature. On two occasions the writer has found this insect on the apple trees right through the year.

The Green Apple Aphis (*Aphis pomi*), which mainly lives on the top shoots and is found also densely packed beneath the leaves or in scattered groups, may curl the foliage, but never to the same extent as does the Blue Bug. Like the latter it winters in the egg stage on the apple and spends its whole life normally on the apple and pear. The writer, however, has recently found it in several localities on thistles (*Carduus*), both as alatae and apterae. In two instances, alatae taken from the apple have produced large colonies when transferred to species of *Carduus* which had been covered with muslin. This is what may be called an "erratic migration." It may be necessary for the continuity of the species, yet it is nevertheless very unusual; just as the migration of the Woolly Aphis to the elm appears to be in this and some other countries. In any case, the aphid returns to the apple and pear in autumn, and the eggs laid on them hatch out from mid April to early May. It increases very slowly at first, but later in June and July it frequently does so very rapidly, especially on young stock. Winged females may be found from the end of June to well

into August, and these migrate to other apple and pear trees, and, it seems, sometimes to thistles. Undoubtedly this species occurs normally all the year on the apple and pear, both in Great Britain and America. In October the sexual forms appear; the males, unlike those of the other two species dealt with here, are wingless. The oviparous females, when pregnant, swarm on to the shoots and deposit their eggs. The ova are pallid at first, but soon become shiny black; they are laid in masses all over the young wood.

The Oat-Apple Aphid (*Siphocoryne avenæ*) also passes the winter on the apple in the egg stage, and sometimes on the pear. The eggs, which are mostly laid singly, hatch out in April, and the young are to be found on the first leaves. The wingless females coming from the larvæ continue to increase throughout May and by the end of the month alate females appear and fly off until mid-June to corn, especially to cultivated and wild oats, but also to barley, wheat and grasses. By October, the corn feeders give rise to winged females, which fly back to the apple and pear and produce young, which become egg-laying females and later on alate males return and fertilise them. The pregnant females then lay eggs on the trees, often as late as November.

Prevention and Treatment.— The matter of prevention is very difficult, if not impossible, for the various host-plants of the Aphides cannot be removed. This may be specially noticed in the case of *Aphis malifoliæ* and *Siphocoryne avenæ*, for it cannot be hoped to destroy all the countless plantains or whatever other plants they attack, and certainly not the cereals and wild grasses.

Reliance must consequently be placed on treatment. This may be carried out by (i.) timely spraying, or (ii.) dusting or dry-spraying the attacked trees. If either of these methods be adopted in the autumn, so as to kill the exposed oviparous females and thus prevent egg-laying, it may prove a preventive in the true sense, for there can be no blight in the following year. The treatment, or what may be called the preventive treatment in the autumn, must be very thorough, as a few apterous egg-laying females left may deposit eggs, and in the spring the young from them may produce a vast progeny.

Any spray used against these pests must be applied heavily, really as a "wash," and not a fine mist. The spray should be applied, when possible, after rain. If rain comes after the spraying, so much the better, as the moisture carries the wash

into all curled leaves and crevices. On the other hand a powder or dust-spray should be applied in dry weather.

In the case of the leaf-curling Apple Aphis (*A. malifoliae*) it is almost useless to spray when the leaf-curling has definitely started, as even with such very penetrative washes as nicotine and pyridine a large number of the insects are not touched and subsequent swarms may occur. Unless spraying for the "Blue Bug" is done when the insects are quite young, that is, before the so-called "Mother Queens" have started to curl the young leaves, it is doubtful if spring spraying is worth the cost.

With the more open-feeding species, such as *Aphis pomi* and *Siphocoryne avenae* it is very different, for any good aphid wash will kill them readily. Unfortunately they are not the most pernicious forms. It seems to the writer, from various experiments carried out during the last 15 years, that autumnal spraying is of special value in this particular case. Spraying to kill the egg-laying forms of all three species, which might be called quasi-prevention, appears to be the most satisfactory method of control. When the apples and pears are harvested, fruit growers are not anxious to spray again, but the writer feels convinced that if they wish to do away with the often serious damage caused by the leaf-curling aphid, they should do so.

Another method of prevention has been found most satisfactory for the "Blue Bug," namely spraying with lime and salt. This should be done when the buds are swelling and just beginning to burst. The young hatched aphides are killed, and many that may hatch later are prevented from entering the opening buds. Some authorities advise lime wash alone, but the writer has found that even a small quantity of salt has a most beneficial effect. The wash is made of—

1 to 1½ cwt. of lime.

5 lb. of salt.

100 gal. of water.

The lime has to be slowly slaked, and run through coarse sacking into the water in which the salt has been dissolved. With suitable sprayers this thick wash can be put on with ease, but readily-cleaned nozzles should be used. The best white lime, and as pure as possible, must be obtained. This also undoubtedly checks attacks of Apple Sucker, cleans the trees, and the materials are washed off into the soil and greatly improve the health of the trees.

For killing most young aphides in spring soft soap and water alone are sufficient if the fluid is applied heavily, just after

the buds have burst. The most successful results obtained have been with 10 lb. of soft soap to 100 gal. of soft water.

If the treatment is left until the leaves are well opening out then nicotine at the rate of 8 oz. to 100 gal. of soft soap wash should be added. Pyridine has been found effectual if used at a greater strength, namely 40 oz., and as it is much cheaper than nicotine it may be recommended. Its penetrative power into curled leaves, however, does not seem to the writer to be as great as nicotine. Pyridine as an aphid killer is certainly of great value as a substitute. As it is the curling of the leaves that make aphides so difficult to deal with even with nicotine or pyridine, we have to look for other treatment. Hence it is in autumn, when all three species return to the apples and pears and do not curl up the leaves, that it seems they should be attacked. The aphides are then freely exposed, and at that time a more potent and normally cheaper insecticide may be safely used, namely, paraffin emulsion. Any possible damage to the foliage will not matter and, moreover, a heavy washing may be given and the drippings will fall on the defoliated matter and kill a large percentage of the egg-laying females that may have fallen with the leaves. Thus the possibility of a spring brood, in any case a large spring brood, is negatived. If this cannot be done, then lime spraying should be employed in early spring.

One other point in connection with the "Blue Bug" is worthy of comment, namely the part ants play in distribution. The writer has time and again watched ants, which attend the plant lice for their rich excretions, carry the aphides off, not only from leaf to leaf, but from tree to tree. There is no doubt whatever that ants play a very prominent part in the dispersal of the "Blue Bug" over a plantation. Consequently all possible steps must be taken to eradicate ant nests. This may be done by digging in naphthalene or pouring boiling water into holes made in the nests.

Natural Enemies. — Aphides have several natural enemies. None appears to control them, however, until they have done the harm. These natural enemies are (i.) parasitic insects, (ii.) predaceous insects, and (iii.) fungoid enemies. The parasitic enemies are small hymenopterous insects, called Chalcid Flies; the predaceous are Lady Bird Beetles and their larvæ or *Coccinellidæ*; the Aphid Lions or larvæ of the Lace Wing Flies (*Chrysopidæ*); the Slug or Leech-like larvæ of the Hover Flies (*Syrphidæ*); and the maggots of certain Gall Midges (*Cecidomyidæ*). The latter seem to be most abundant in

North Britain. None of these, however, appears to be of any practical help on a large scale, and no reliance can be placed on them as a means of checking "Aphis Blights."

The fungoid enemies, of which there are many, also appear too late to stop an epidemic, and when they attack late colonies, that is after all the damage has been done, a few Plant Lice escape, enough to produce, under favourable circumstances, a blight in the following season, with which the fruit grower has to contend.

POTATO-SPRAYING EXPERIMENTS AT WYE COLLEGE FRUIT EXPERIMENT STATION, EAST MALLING, KENT.

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WHILE it is the almost invariable practice of the present-day farmer to spray the main crop varieties of potatoes to protect them from "blight," the practice of spraying second-early varieties, such as "British Queen," is by no means general. Yet in many seasons it is a common sight to see such early varieties struck down by "blight" before the haulm has ripened off.

A series of field experiments in which plots of "British Queen" were sprayed either once or twice with Bordeaux or Burgundy mixture was carried out during 1918, in order to obtain definite data as to the value of spraying such a variety. A small grant was obtained from the Food Production Department of the Board of Agriculture for the purpose.

The somewhat paradoxical conclusion was established that under certain seasonal conditions spraying a second-early crop once may result in a dead loss, while spraying twice under the same conditions will result in a very substantial increase of the crop of sound tubers.

Plan of the Experiments.—The variety of potato used for the spraying experiments was "British Queen" (Scotch seed). The field was divided into 20 plots, each of which contained 18 rows of potatoes and was 0.39 acre in area. The distance between the rows was 2 ft. 6 in. and between the sets, 1 ft. 2 ins. The seed, which was not sprouted, was planted on 9th to 18th April, at the rate of about 16 cwt. to the acre. The whole field was uniform as regards previous cropping, cultivation and

manuring. Twenty-five tons of London dung per acre were applied in February, 1918, previous to being ploughed in with the wheat stubble ; and 4 cwt. superphosphate (30 per cent.) and $\frac{3}{4}$ cwt. sulphate of ammonia per acre were sown up the drills at time of planting.

The experiments consisted of spraying with Bordeaux and Burgundy mixtures of two strengths, as described below, and of contrasting the effect of one application with two applications. Thus there was a set of eight different treatments ; these were duplicated, so that sixteen plots were used, while four unsprayed plots served as controls, the latter being so placed that a control plot adjoined one plot used in each of the eight treatments (see plan on p. 74).

Mixtures Used and their Method of Preparation.—The mixtures used for spraying were Bordeaux mixture and Burgundy mixture, each at two strengths, viz., (1) containing 1 per cent. copper sulphate, and (2) containing 1.4 per cent. copper sulphate.

Stock solutions of copper sulphate and of washing soda, at the rate of 2 lb. to 1 gal. of water, and "milk of lime" at the rate of 1 lb. of quicklime to the gallon, were prepared as follows :

The stock solutions were made in barrels to hold 20 or 40 gal., the barrels having been carefully measured and marked at the 20-gal. or 40-gal. level. To make 20 gal. of the copper sulphate stock solution 40 lb. of copper sulphate were weighed out and placed in a barrel to which water was then added until the 20-gal. mark was reached ; after a few stirrings at intervals the copper sulphate was dissolved. The soda stock solution was similarly prepared. To make 20 gal. "milk of lime," 20 lb. of freshly-burnt quicklime were placed in a barrel and a few gallons of water gradually added until the lumps broke down to form a thick, creamy paste ; more water was then added until the 20-gal. mark was reached. This milk of lime was well stirred each time immediately before use.

The Burgundy mixtures were made up in large wooden tubs and the Bordeaux mixtures in galvanised iron tanks. They were prepared in the following manner :—

1 per cent. Burgundy mixture. Formula.—

Copper sulphate	..	..	..	10 lb.
Washing soda	..	..	..	12 $\frac{1}{2}$ lb.
Water	..	..	..	100 gal.

88 $\frac{1}{2}$ gal. of water were placed in the tub, 5 gal. of copper sulphate stock solution were added, and then 6 $\frac{1}{2}$ gal. of soda stock solution were added gradually and well stirred in.

1·4 per cent. Burgundy mixture. Formula.—

Copper sulphate	..	..	..	14 lb.
Washing soda	..	..	..	17½ lb.
Water	..	..	..	100 gal.

This was prepared similarly in the following proportions:—

84½ gal water ; 7 gal. copper sulphate stock solution ; 8½ gal. soda stock solution.

Both these Burgundy mixtures, as soon as made, were found to satisfy a test with blue litmus paper. No "scorching" occurred to the foliage on any of the plots sprayed with these mixtures.

1 per cent. Bordeaux mixture. Formula.—

Copper sulphate	..	..	..	10 lb.
Quicklime	..	..	..	6 lb.
Water	..	..	..	100 gal.

89 gal. of water were placed in the tank, 6 gal. of "milk of lime" were added, and then 5 gal. of copper sulphate solution were poured into the centre and the mixture stirred.

1·4 per cent. Bordeaux mixture. Formula.—

Copper sulphate	..	..	..	14 lb.
Quicklime	..	..	..	9 lb.
Water	..	..	..	100 gal.

This was prepared similarly in the following proportions:—

84 gal. of water ; 9 gal. of milk of lime ; 7 gal. of copper sulphate stock solution.

Method of Application of Mixtures.—All the mixtures were applied with Weeks's Horse Potato Sprayer. This machine distributed the mixtures in a fine, misty spray over the under and upper surfaces of the leaves at the uniform rate of 165 gal. to the acre. With many horse machines it is not possible to apply this quantity per acre, and it should be remembered that with an average amount of haulm, at least 150 gal. are required to spray one acre thoroughly.

The dates of the sprayings were 1st July for the Burgundy mixtures, 2nd July for the Bordeaux mixtures (first applications) and 19th July for the second application of both mixtures.

The weather conditions on these dates and subsequently were as follows:—

July 1.—Very hot sunshine ; cloudless sky.

July 2.—Occasional sunshine ; sky overcast ; cool wind.

July 3–11.—Hot and dry.

July 12–18.—Showery weather.

July 19.—Fine, showers at intervals.

July 20.—Heavy rain and storm.

July 21–27.—Showery ; hot.

July 28–August 8.—Showery ; hot and muggy.

Aug. 9–24.—Hot and dry.

Weather during September and October showery, and potatoes very wet when lifted during the middle of October to the middle of November.

The application of the various mixtures and the weighing of the crop of the different plots were carried out by Messrs. J. Amos and A. W. Witt, of the East Malling Fruit Station, whose help the writers wish to acknowledge.

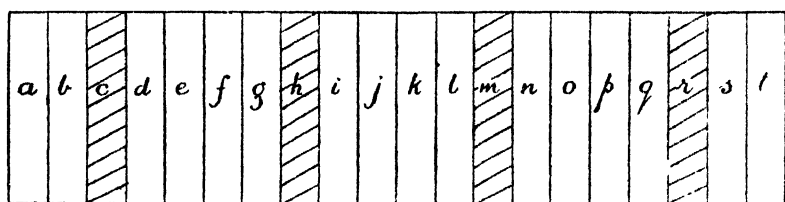


FIG. 1.—Plan of the Experiments. Each plot was 0·39 acres in area

<i>Mixture.</i>	
<i>a, l, 10</i> per cent. Bordeaux	.. 1 application.
<i>b, k, 10</i> „ Burgundy	.. 1 „
<i>j, s, 1·4</i> „ Bordeaux	.. 1 „
<i>i, t, 1·4</i> „ Burgundy	.. 1 „
<i>d, o, 10</i> „ Bordeaux	.. 2 applications.
<i>e, n, 10</i> „ Burgundy	.. 2 „
<i>g, p, 1·4</i> „ Bordeaux	.. 2 „
<i>f, q, 1·4</i> „ Burgundy	.. 2 „
<i>c, h, m, r, Control plots (unsprayed).</i>	

Observations on the Sprayed and Control Plots.—

Plot. *Date of Observation, 24th August.*

- A.—Slight to fair amount of blight on foliage; crop beginning to ripen off.
- B.—Fair amount of blight on foliage.
- C.—Haulm practically all blighted.
- D.—About the same as A, or perhaps a little less blight.
- E.— } A little less blight than in A.
- F.— }
- G.—Decidedly the best of these plots, practically no blight on haulm.
- H.—Haulm very badly blighted, sometimes brown and dead; sometimes brown with some green growth at tips.
- I.—Blight general on tips of leaves; somewhat similar to A.
- J.—Less blight than in I, *i.e.*, not so general.
- K.—Same as I.
- L.—Somewhat variable, but on the whole like I.
- M.—Similar to C, practically no green haulm present.
- N.—Blight present to only slight extent.
- O.— } More haulm than in other plots, and practically no blight;
- P.— } the best plot or equal to best.
- Q.—Some blight on foliage, but not much.
- R.—Haulm nearly all destroyed by blight; here and there some green growth still visible.
- S.—Slight amount of blight on tips of leaves, approaching the best plots.
- T.—Not quite so healthy as S.



Yield of Plots and Results of Spraying.—Table I. gives the actual yield, as weighed in the field when the crop was lifted, of the 4 middle rows of each plot, and also the weights of the ware and of the blighted tubers and the percentage of each in the total crop.

It will be seen that the percentage of blighted tubers is least in the control plots; this is to be explained by the fact that

TABLE I.

Mixture.	Plot.	Total Crop.		Ware.		Blighted Tubers.	Blighted Tubers.
		cwt.	lb.	cwt.	lb.	cwt.	lb.
1% Bordeaux once	A	18	0	14	86	0	66
1% Burgundy once	B	18	77	11	34	0	83
Control ..	C	18	60	13	21	0	14
1% Bordeaux twice ..	D	22	109	15	50	0	48
1% Burgundy twice ..	E	21	88	14	74	0	22
1.4% Burgundy twice ..	F	21	72	14	65	0	46
1.4% Bordeaux twice ..	G	21	49	15	61	0	57
Control ..	H	20	92	13	77	0	10
1.4% Burgundy once ..	I	20	108	15	86	0	51
1.4% Bordeaux once ..	J	20	86	15	88	0	28
1% Burgundy once ..	K	19	70	11	0	2	85
1% Bordeaux once ..	L	19	19	12	89	1	8
Control ..	M	17	15	11	0	0	18
1% Burgundy twice ..	N	20	15	14	10	1	0
1% Bordeaux twice ..	O	22	24	15	34	1	14
1.4% Bordeaux twice ..	P	21	23	15	29	0	102
1.4% Burgundy twice ..	Q	16	25	12	18	0	56
Control ..	R	18	50	13	1	0	50
1.4% Bordeaux once ..	S	18	67	12	21	1	10
1.4% Burgundy once ..	T	18	8	12	75	0	100

the haulm in these plots ripened off before the blight was able to attack the tubers to any extent.

The results of spraying as shown by the increased yield or otherwise of sound tubers can be ascertained if the yield of the sprayed plot be compared with its nearest control plot (see plan). The highest increase is found in the plots sprayed twice with 1 per cent. Bordeaux mixture. The crop of sound

tubers of the 4 middle rows of Plot D was 22 cwt. 61 lb., as compared with 18 cwt. 46 lb. for that of the control plot C—an increase of 4 cwt. 15 lb. The similar increase of Plot O over the control Plot M was 4 cwt. 13 lb. This gives an increase of 8 cwt. 28 lb. for the 8 rows, or 2 tons 7 cwt. 49 lb. to the acre, since there were 46 rows to the acre.

Similar results were obtained with the Plots E and N sprayed twice with 1 per cent. Burgundy mixture; here there was an increase on an acreage basis of 1 ton 10 cwt. 78 lb. over the control Plots C and M.

The beneficial results of these sprayings are to be attributed to the action of the mixtures in lengthening the period of growth (*i.e.*, in delaying the natural ripening-off), and at the same time protecting the haulm from attacks of the blight.

In the case of the plots sprayed once with 1 per cent. Burgundy mixture, 1.4 per cent. Burgundy mixture, or 1.4 per cent. Bordeaux mixture, there was a decrease in the yield of sound tubers, the figures on an acreage basis being as follows: 1 per cent. Burgundy mixture, 3½ cwt.; 1.4 per cent. Burgundy mixture, 6 cwt.; 1.4 per cent. Bordeaux mixture, 4 cwt. This loss may be attributed to the fact that the single spraying delayed the natural ripening off and was not sufficient to protect the fresh growth when the attacks of the blight came.

In all the above cases the duplicate plots agreed in giving plus or minus results; in the two remaining cases this agreement was not found. Of the duplicate plots sprayed once with 1 per cent. Bordeaux mixture, Plot A showed (for the 4 middle rows) a decreased yield of sound tubers of 1 cwt., compared with that of the control plot C; while Plot L showed an increase of 1 cwt. 14 lb. over the control Plot M. In the other case, of the duplicate plots sprayed twice with 1.4 per cent. Burgundy mixture, Plot F showed an increase of 56 lb. over the control Plot H, while Plot Q showed a decrease of 2 cwt. 31 lb. compared with the control Plot R. No conclusions can, therefore, be safely drawn from these two cases.

Table II. summarises the results of all the spraying trials, the figures given being the increase or decrease per acre of the crop of sound tubers as compared with the crop of the respective control plots.

It is obvious that the value of spraying cannot be decided from the results of one particular season, but from those of a succession of seasons.

TABLE II.

					Increase.	Decrease.
					cwt.	cwt.
1	per cent.	Bordeaux mixture,	applied once*	..	—	—
1	"	Burgundy	" " "	..	—	3½
1	"	Bordeaux	" " twice	..	47½	—
1	"	Burgundy	" " "	..	30½	—
1·4	"	Bordeaux	" " once	..	—	4
1·4	"	Burgundy	" " "	..	—	6
1·4	"	Bordeaux	" " twice	..	14½	—
1·4	"	Burgundy	" " " *	..	—	—

* In this case contradictory results were given by the duplicate plots, and they are therefore not included in this Table.

Summary.—1. Under certain seasonal conditions one application of Bordeaux or Burgundy mixture to a second-early variety of potatoes may result in loss, owing to the spraying lengthening the period of ripening while not protecting the crop from attacks of blight.

2. Under the same seasonal conditions as referred to above, two sprayings with either Bordeaux or Burgundy mixture resulted in an increase of 2½ tons and 1½ tons, respectively, of sound tubers to the acre.

THE WORK OF THE MINISTRY OF RECONSTRUCTION IN THE DEVELOPMENT OF AGRICULTURE.

A BRIEF account of some of the steps which have been taken with a view to improving the agriculture of this country is given in the Report on the work of the Ministry of Reconstruction for the period ended 31st December, 1918 (Cd. 9231, 1919), recently issued. The Ministry was constituted in 1917, the duties of the Minister being to consider and advise upon the problems arising from the War, and make such recommendations and prepare such schemes as he thinks fit. Various committees were appointed to consider particular questions, and the Report is in the main a statement of the action which has been taken as the result of recommendations made by these committees.

The work of the Ministry in regard to agriculture is dealt with by a Rural Development Branch, which it is stated deals with the aspects of reconstruction questions specifically affecting

the rural areas of the United Kingdom and the development of its resources in land and agriculture. The Report remarks that it is one of the main general problems of reconstruction to secure a readjustment of the population between urban and rural areas, in the interests of improved health and development of the natural resources of the United Kingdom ; and this problem requires to be studied comprehensively with a view to the co-ordination of general reconstruction policy to this end. The Branch has been co-operating closely throughout with the Board of Agriculture and other Departments concerned. In certain directions, however, it has been able not only to co-ordinate proposals from other Departments into a reasoned policy of rural development, but also to contribute constructive work on points not otherwise provided for departmentally.

The following account of the measures which have been taken in the reconstruction of agriculture is taken from the Report :—

Agricultural Policy Committee.—The First Part of the Report* of the Agricultural Policy Committee (under the chairmanship of Lord Selborne) had been submitted to the Prime Minister on 30th January, 1917, and dealt with the problem of rendering the United Kingdom self-supporting in the matter of food supply so far as is economically possible. Upon the basis of this Report the Corn Production Act, 1917, was passed as an emergency measure, providing for guaranteed minimum prices of corn, the fixing of minimum wages through the establishment of Wages Boards, and certain measures for State control of agricultural operations in the interests of increased production. Special attention has been given to the question of a suitable machinery for the administration of any permanent policy, on the assumption that the State may continue to exercise some measure of supervision over the operations necessary for increased production of the home food supply in the national interest. Memoranda have been submitted to the Board of Agriculture containing proposals :—

- (a) For the reorganisation of the work of County Councils in view of the possible formation of "County Council Agricultural Committees," and for the co-ordination of the work of such Councils in so far as it directly affects agriculture ; and
- (b) for the creation of "County Authorities" directly responsible to the Board of Agriculture for carrying on such of the duties of the War Executive Committees as may necessarily have to be continued on a permanent footing, and such other executive duties as might more conveniently be discharged by an authority acting under the instructions of the Board, than by the County Council Agricultural Committees.

* Cd. 8506, 1917. See this *Journal*, April, 1917. p. 1.

The Second Part of the Report of the Agricultural Policy Committee.—

This Report* was submitted on the 30th January, 1918. It contained various proposals for the reorganisation of the Departments dealing with agriculture, with questions of agricultural instruction and research, with co-operation and organisation for the disposal of agricultural produce, agricultural credit, small holdings, village reconstruction, tithe redemption, local taxation, amendments in the Agricultural Holdings Acts, land reclamation and drainage, plant pathology, the supply of artificial manures, weights and measures, and agricultural transport. Many of these specific schemes have been worked out by the Rural Development Branch in consultation with the Board of Agriculture, or proposals have been submitted to the Board of Agriculture for consideration. In other cases, memoranda have been prepared and further information has been collected with a view to the formulation of definite proposals.

Tithe Redemption.—The question of tithe redemption was dealt with in the Tithe Act, 1918, which was introduced by the Board of Agriculture after consultation with the Ministry of Reconstruction. Proposed amendments in the Small Holdings and Allotments Acts have also been the subject of full discussion and interchange of memoranda between this Branch and the Board of Agriculture; and as the result of a joint memorandum by the President of the Board of Agriculture and the Minister of Reconstruction, the Government have introduced a Bill providing, *inter alia*, for facilitating the acquisition of land for small holdings by payment of annuities.

Village Reconstruction and Rural Industries.—On the general question of village reconstruction a large amount of material has been collected in this Branch and a general scheme prepared in outline, covering such questions as the provision of village halls, recreation grounds and increased amenities of village life. A memorandum has been submitted to the Board of Agriculture, with a questionnaire to be addressed to local authorities, for the purpose of ascertaining what are the specific requirements of the different localities in this connection. The question of stimulating and developing rural industries has been made the subject of a full and detailed investigation in various parts of the country by an officer specially attached to this Branch. The information thus collected has since been analysed with a view to the submission of concrete proposals.

* Cd. 9079, 1918. See this *Journal*, July, 1918, p. 385.

Rural Transport. Light Railways.—Various schemes for the development of rural transport facilities have been worked out in consultation with the other Departments concerned. In particular, attention has been devoted to the possibility of developing a comprehensive system of narrow-gauge light railways in rural areas. In this connection advantage has been taken of the experience gained during the War in utilising narrow-gauge railways in the zone of active operations. The possibility of taking advantage of the experience thus gained, and any surplus stores of equipment available at the end of the War for a general development of such light railways in rural areas, has been explored. Proposals have been submitted to the Board of Trade for the establishment of a central authority to deal with the matter, and obtaining the necessary powers and facilities for developing such schemes.

Forestry.—The Report† of the Forestry Committee (under the chairmanship of Mr. F. D. Acland, M.P.) has resulted in an Interim Forestry Authority being set up under Mr. Acland, and a sum of £100,000 has been voted by Parliament for the commencement of immediate operations (including the training of Forestry Officers, the collection of seeds and nursery stocks, and the making of preliminary surveys), in preparation for a comprehensive scheme for which legislative powers will be sought in due course.

Land for Sailors' and Soldiers' Settlements.—Immediately on the formation of the Ministry in August, 1917, special attention was devoted to the question of making adequate provision for the settlement of ex-service men on the land. The only special provision for this purpose at that date was under the Small Holdings (Colonies) Act, 1916, under which 8,000 acres could be made available for training and settlement (as an experimental measure) of service men in farming colonies on a co-operative basis. It was felt that arrangements should at once be made for a more comprehensive scheme to satisfy the requirements of ex-service men who might desire to be settled on the land. Various proposals for meeting such requirements by a general scheme for the acquisition of glebe lands and estates in the hands of colleges, charities and the like by the Board of Agriculture were considered; but it was found that it would not be possible to make the necessary provision by such means within the time available. It was accordingly proposed, as the result of joint deliberations by the Ministry of Reconstruction and the Board of Agriculture in May, 1918, that power should

† Cd. 8881, 1918. See this *Journal*, February, 1918, p. 1251.

be immediately obtained for the acquisition (by compulsion if necessary) of large areas of land (as and where required) for the purposes of sailors' and soldiers' settlements, small holdings, forestry, reclamation and rural housing. It was recommended by the Ministry that action in this matter should be taken, so far as possible, through the ordinary machinery of the County Councils, under the Small Holdings Acts, on the basis of an annual payment guaranteed by the State. These proposals were referred to a Cabinet Committee, who approved them in principle, and a Small Holdings and Allotments Bill incorporating this principle was introduced into Parliament at the end of the last session. The sudden developments in the military situation made it necessary, however, to provide at once for the acquisition of the land necessary for sailors' and soldiers' settlements by cash payments, to avoid the delay incident to negotiations or compulsory proceedings likely to arise upon a basis of annual payment. Revised proposals have accordingly been prepared, and accepted by the Government, for the immediate provision of a capital sum calculated to meet all requirements (both as regards land acquisition, equipment and training) for the settlement of ex-service men.

Means for Attracting Returning Sailors and Soldiers to the Land.—

Concurrently with the arrangements initiated (as described above) to obtain land for the settlement of ex-service men, steps were taken to consider suitable methods for making rural life attractive to such men. Section IV. of the Minister's Advisory Council (under the chairmanship of Mr. Leslie Scott, K.C., M.P.,) were accordingly asked, in March, 1918, to report upon the following reference :—

“ To consider the steps and conditions (apart from the provision of Farm and Small Holding Colonies) necessary to attract to employment on the land all returning soldiers and sailors who may wish to take up country life ; and in particular to induce them to do so in sufficient numbers to secure the maximum output on the land.”

The Section, who in the course of their inquiry have submitted various resolutions upon which interim action has been taken, submitted in December, 1918, their Final Report.* These recommendations embrace increased facilities for rural housing and acquisition of land for small holdings, etc., adequate provision for the training of officers and men desirous of taking up an agricultural life, improved organisation for agricultural trade purposes and general provision for increased amenities of village life. In particular they recommend (as an essential

* Not yet published.

preliminary measure to any effective action for the general purpose in view) the immediate establishment of a Central Executive Committee, including representatives of the various Departments and organisations specially interested in the different aspects of the general problem of settling ex-service men on the land and providing facilities for their training and allocation for such employment. The recommendations of the Committee have been carefully considered by the Department.

Rural Information Offices.—Section IV. of the Advisory Council were also asked, early in 1918, “to consider a scheme drawn up by the Rural Development Branch for the establishment of Rural Information Offices to centralise at suitable places in each locality the provision of any information available from official sources that might be of interest or value to the local agricultural community.” The Section recommended, in February, that the scheme should be set in motion experimentally by the Board of Agriculture at certain selected centres, and, after consideration of the Report* by the Minister of Reconstruction, recommendations were made to the Board of Agriculture accordingly.

Economic Position of Women in Agriculture.—Arrangements have been made, in consultation with the Women’s Employment Committee and Food Production Department, to pursue further certain questions relative to the employment of women in agriculture through Sub-Committees of Section IV. of the Advisory Council of the Ministry of Reconstruction. To deal with this question as regards conditions obtaining in England and Wales, a Sub-Committee (under the chairmanship of Mrs. Roland Wilkins) has been appointed, with the following reference :—

“To consider what economic part women can take in the development of agriculture, having particular regard to the Report presented by the Agricultural Policy Committee, and to recommend what steps should be taken to give practical effect to such conclusions as may be drawn.” Arrangements have also been made, in consultation with the Women’s Employment Committee and the Scottish Office, to set up a similar Sub-Committee of Section IV. of the Advisory Council (under the chairmanship of Mrs. C. D. Douglas) to report upon the same matter relative to conditions obtaining in Scotland.

General Questions of Land Reform.—The general question of the acquisition and valuation of land for public purposes in its

* Not published.

different aspects is being pursued by the Land Acquisition Committee. The question of registration of title has also been referred to a Sub-Committee of the Land Acquisition Committee. The Rural Development Branch have also considered and prepared memoranda upon various proposals submitted to the Ministry of Reconstruction dealing with the question of the taxation of land values, nationalisation of land, and the like.

Miscellaneous.—The Minister of Reconstruction invited the County Councils of the United Kingdom to furnish information in regard to schemes in connection with rural reconstruction that had come under their notice, and any information that they might desire to submit in regard to the particular needs of their own localities.

A representative Conference of the agricultural industry was summoned to consider the question of setting up an Interim Reconstruction Committee for Agriculture, and as a result a scheme is now in course of preparation.

Spring Dressings may Still be Used in certain Cases.—Owing to the coldness of the weather during most of March and the resulting

**Notes on Manures
for May:**

*From the Rothamsted
Experimental Station.*

backward conditions of the corn crops it is still possible to use spring dressings in certain cases where no manure was supplied in the autumn, and where the crop is beginning to show signs of suffering. At this stage, however, the choice of dressings is restricted to nitrates, though it is not very material which of the three is selected—whether nitrate of soda, nitrate of ammonia or nitrate of lime. All three are good, and nitrate of ammonia, though new to the farmer, is as quick in action as the others and is more concentrated, so that only half as much per acre is needed to produce the same effect.

Fertilisers for Barley.—In many parts of the country the sowing of barley will be later than usual, so that there is some risk of delayed growth and ripening, which is always undesirable where quality is desired. This effect can be counteracted to some extent by drilling with the seed a mixture of 2 cwt. of superphosphate and 1 cwt. of sulphate of ammonia per acre. The effect of the superphosphate is to give the young

plant an earlier start than would otherwise be possible, and to hasten the ripening process at the end of the period of active growth. The sulphate of ammonia also helps the plant to make an early start and to grow away without check, but it should not be used where the land has been folded.

On light lands there is sometimes an advantage in giving 2 cwt. of salt instead of the 1 cwt. of sulphate of ammonia, especially where the barley is grown after roots which have been fed off.

Fertilisers for Spring Oats.—Spring oats are liable to the attack of eelworms, but there is evidence that their power of resistance is increased when there is a liberal supply of potash in the soil. Unfortunately potassic fertilisers are still dear, but in many cases, especially where farmyard manure has been applied within the last two or three years, a dressing of 2 cwt. of salt causes an increase in the supply of available potash. Where spring oats must be grown, and the attack of eelworm is feared, this dressing of salt should not be omitted.

Fertilisers for Potatoes.—Provision must now be made for the supply of fertilisers for the potato and root crops if this has not already been done.

It has repeatedly been shown that a small dressing of dung—10 tons to the acre—supplemented by artificials usually gives larger crops of better quality than larger dressings of dung.

A suitable dressing is 10 to 15 tons of dung at the time of planting in the north, but in winter, if possible, in the south and west, and supplemented by the following:—

1 cwt. sulphate of ammonia, 4 cwt. superphosphate, 1 cwt. sulphate or muriate of potash; or 1½ cwt. sulphate of ammonia, 4 cwt. superphosphate, 1½ cwt. sulphate or muriate of potash.

Where no dung has been used the dressing of artificials must be increased. In these circumstances the Lancashire recommendation is 2½ cwt. sulphate of ammonia, 6 cwt. superphosphate, and 2 cwt. muriate of potash. In many districts, however, this dressing of superphosphate would be excessive: probably in the Eastern Counties considerably less might be used. In North Wales, however, phosphates are very effective and can be liberally applied: possibly the nature of the soil and the high rainfall are important factors.

There is no point in giving too much nitrogen or too much phosphate; excess of nitrogen only produces excess of haulm and may reduce quality, while excess of phosphate may hasten ripening and bring the growing season to an end. These points

are illustrated in the following experiments taken from the Devon Report :—

Yield of Potatoes per Acre.

<i>Increasing Phosphate.</i>	<i>Increasing Nitrogen.</i>	<i>Increasing Potash.</i>
T. cwt.	T. cwt.	T. cwt.
400 lb. super + sulphate of ammonia and sulphate of potash ... 8 8	256 lb. sulphate of ammonia, + sulphate of potash ... 8 8	192 lb. sulphate of potash, + superphosphate and sulphate of ammonia ... 8 8
533 lb. super + sulphate of ammonia and sulphate of potash ... 7 13½	341 lb. sulphate of ammonia, + superphosphate and sulphate of potash 7 11½	256 lb. sulphate of potash, + superphosphate and sulphate of ammonia ... 8 18½

In the Glasgow experiments a mixture of basic slag and superphosphate (3 cwt. of each) was better than superphosphate alone; at Holmes Chapel steamed bone flour (3 cwt.) was better than either. In the Northumberland and Durham districts 2 cwt. of high grade basic slag is recommended in partial replacement of the superphosphate, and the following dressing is suggested :—

10 to 12 tons dung.	2 cwt. basic slag.
1 cwt. sulphate of ammonia.	1½ cwt. superphosphate.

In the North potatoes are usually planted in drills about 30 in. apart. The drills are first opened with a double mould-board plough, and the dung is spread evenly in the bottom of these drills. On the top of the dung the artificial manures are applied, then the potatoes are planted, and the drills covered. It is advantageous to apply the basic slag by itself, as when this fertiliser is mixed with sulphate of ammonia and superphosphate there is likely to be a loss of ammonia, and, further, the mixture does not distribute well.

Where dung was applied the omission of potash did not prove serious in cool, moist districts, *e.g.*, Lancashire, Wales, and Somerset, or in land in good condition in Herts. In these circumstances, therefore, the grower need not be over anxious if he cannot get potash, so long as he has dung; he can use 1 to 2 cwt. of sulphate of ammonia and 4 cwt. of superphosphate, or 2 cwt. of bone meal, in addition to the dung.

Where no dung was applied, and in the more forward districts on lighter soils, however, *e.g.*, Herefordshire, Devon, Bedford, Wiltshire, potash has proved more necessary, and greater efforts must be made to secure it.

On peaty soils the dressings of sulphate of ammonia can be reduced, and in the Fens it can be dispensed with altogether.

On clay Fen land the following has worked well: no dung,

up to 8 cwt superphosphate; on silty Fen lands—no dung, 4 to 6 cwt. superphosphate, $\frac{1}{2}$ cwt. sulphate of potash.

On the whole, sulphate of ammonia and superphosphate have proved better than nitrate of soda and basic slag, both of which rather tend to set up alkaline conditions favourable to scab. Lime is to be avoided for the same reason.

No grower should omit to spray the main crop varieties.

Fertilisers for Mangolds.—The mangold responds to liberal manuring, and in view of its extraordinary utility to the dairyman it should be well treated.

In most cases this crop receives a good dressing of dung, but in addition it responds to nitrogenous fertilisers and salt. Phosphates are only needed to give the young plants a start and to bring them quickly to the hoe. Suitable dressings are:—

Up to 20 loads of dung.

1 cwt. sulphate of ammonia, 2 to 4 cwt. superphosphate or basic slag, 4 cwt. kainit or 1 cwt. sulphate or muriate of potash, 2 to 4 cwt. salt in the drills.

$1\frac{1}{2}$ cwt. nitrate of soda as a top dressing when the plants are hoed and singled.

Slag proved better than superphosphate in the Northumberland experiments on a light, sandy loam under relatively low rainfall. On the other hand, in the Midland Agricultural College experiments superphosphate proved the better: here also the soil was light and the season dry. The yields were:—

Basal dressing + superphosphate ...	35 tons $5\frac{1}{2}$ cwt.
„ „ + slag ...	27 „ $17\frac{1}{2}$ „

On black Fen soils, however, 6 cwt. superphosphate alone, without dung or other fertiliser, proves sufficient.

Few farmers use salt as much as they might for mangolds, and yet salt has been repeatedly shown to benefit them. Thus the following results have been obtained at Woburn:—

	Un- manured.	No Salt.	1 cwt. Salt	2 cwt. Salt.	4 cwt. Salt.	6 cwt. Salt.
Mean of four varieties, tons per acre ...	27.0	30.9	30.6	34.3	34.6	36.3

All plots except the unmanured received 1 cwt. nitrate of soda per acre.

At the Harper Adams College the results for the three seasons 1913-15 were:—

No Salt	5 cwt. Salt after Sowing.	10 cwt. Salt after Sowing.	
27½	35½	36	tons per acre.

All plots received farmyard manure, and, in addition, 2 cwt. of dissolved bones, $\frac{1}{2}$ cwt. superphosphate and $\frac{1}{2}$ cwt. sulphate of ammonia per acre.

In the Cockle Park trials, 2 cwt. of salt increased the yield of mangolds by nearly 4 tons per acre on an average of 5 years.

On light soils it may be advantageous to apply salt in top dressings even if some had already been given in drills. At the Midland Agricultural College a top dressing of 1 cwt. proved very effective, in spite of the fact that 3 cwt. has been applied in the drills at seed time :—

Plot.	Nitrogenous Top-dressing per Acre.	Yield per Acre.		Increase from Salt per Acre.
		Without Salt.	With Salt.	
		Tons cwt.	Tons cwt.	Tons cwt.
1	None	20 0½	31 19½	5 18½
2	Nitrate of soda, 1 cwt.	29 17	34 19½	5 2½
3	Nitrate of lime, 1½ cwt.	29 0½	34 4½	4 17½
4	Granular nitrolim, 1 cwt.	29 18½	33 14	3 15½

Liquid Manure on Young Seeds.—Where dairy farmers have arrangements for collecting liquid manure they may with great advantage put it on the young seeds at this stage of growth. A suitable dressing is 1,500 gal. per acre, and it has been found that one man, one horse and one boy can do about four-fifths of an acre per day. The function of the boy is to walk behind and see that the liquid is discharging properly, and if there is a stoppage to clear it away. Before pumping begins it is desirable to stir up the liquid so as to bring as much as possible of the sediment into the cart, and thus save the very dirty work of clearing out the tank with buckets.

THE considerable and sudden fall in the price of eggs makes the question of economy of feeding for egg production one of

**Notes on Poultry
Feeding :**

*From the Harper
Adams Agricultural
College, Newport,
Salop.*

of paramount importance. Fortunately the range of feeding stuffs obtainable is now considerably increased, and conditions are approaching more nearly to the normal in the matter of supplies.

Maize and maize meal are the foods that are most difficult to obtain, though the poultry grain mixtures contain only a small proportion of the former. Examination of the feeding records of a poultry flock kept intensively for egg production shows that in previous years when maize meal was obtainable it comprised over one-tenth part

by weight of the mash feed, while the present feeding records show that none has been fed, although the cold season, when this ingredient of the mash is most valuable, has been a prolonged one.

The following quantities, extracted from the recent feeding records of a flock of 700 birds kept exclusively for egg production, are given as an indication of their requirements per month of 28 days.

Grain (consisting of feed wheat, oats, and maize), 2,583 lb :
bran, 250 lb. ; fish meal 405 lb. ; clover meal, 158 lb. ; ground oats,
405 lb. ; sharps, 450 lb. ; compound meal, 555 lb. Total meals
given as a wet mash 2,223 lb.

The satisfactory result to be obtained from the constant and frequent change in the ration, which is now made possible by increasing supplies, is illustrated by the food cost per dozen eggs in a flock so managed. This cost, for an early period of the present year, amounted to 2s. 6d. per dozen. The recent fall in the price of eggs to the consumer to approximately this figure in the country markets—though seasonal egg yields will have increased somewhat since this figure was taken out—emphasises the need for economical feeding and for taking advantage of the wider choice of materials now on offer. The only noteworthy shortage is of some imported products chiefly of value for the oil they contain, as is the case with maize and maize meal instanced above. A similar reason may be assigned for the presence on the market of many unsatisfactory small grain mixtures largely used by the poultry rearer for chick feeding. Examinations of samples recently obtained show entire absence of linseed, crushed hempseed, and most of the products usually of tropical or sub-tropical origin that are particularly valuable on account of their heat-giving properties. An increased proportion of ordinary cereal grains in such mixtures cannot be expected to supply this deficiency, and it is quite conceivable that the use of such mixtures, particularly if the cereals are of damaged or second-rate quality, will react unfavourably upon the percentage of early broods reared.

Large quantities of weed seeds are also present in many samples of chick feeds now on sale, and such should be regarded with suspicion. A report of recent work at the Harper Adams College on the use of castor bean meal for poultry indicates the extent of the risk in using untried foods for adult birds, and shows that the need for the rigid exclusion of foreign material from the dietary of the young stock is a matter of at least equal importance.

GREAT losses are caused annually amongst fowls by outbreaks of roup. It is well known that perfectly healthy flocks are often infected by the introduction of purchased birds. The purchaser has, however, little hope of proving the responsibility of the vendor for introducing the disease in making a claim for compensation, and a warning to the unwary to protect themselves as far as possible by purchasing only on approval, and by careful examination of the birds upon arrival, requires constant repetition.

**The Spreading
of Roup
Amongst Poultry.**

Isolation.—The isolation of purchased birds must not be neglected, even after careful examination has given no cause for suspecting the presence of disease. Clean, dry surroundings should be given, free from draught, and the isolated fowls should be afforded room for exercise. Too often the conditions are unsuitable for birds fresh from a railway journey. A coop on the ground is most unsatisfactory. A chill or digestive trouble may have been contracted on the journey, or will follow with careless treatment, which may lower the vitality of the bird and weaken its resistance to disease. An exhibition cage with wire front and top, placed in an airy and well-lighted shed, forms the most suitable pen for isolation. This cage should be cleansed after each occupant.

Examination.—Very frequently the bird has the roup before being sent out, sometimes in an advanced form. Some birds are carriers, in which case detection is less easy. The examination must be very carefully made, although, in bad cases, even a novice will know that something is wrong by the very offensive smell. This smell once experienced is not forgotten. The test should be made by examining the inside of the mouth and under the tongue for whitish or yellow growths. These may be quite small and firmly embedded in the membrane, or they may be almost free, but in either case they invariably have the characteristic smell. The nostrils should be pressed, and if matter exudes and the smell is offensive, roup can be suspected. In some cases the mouth and nostrils are clear, but the eyes are affected, and although this is not such a bad form of the disease and is often more easily curable, it is very infectious. When examining a bird, particular attention should be paid to the feathers on the wing, where the bird frequently rubs its head to ease inflammation and irritation.

Treatment.—Birds purchased upon three days' approval and showing any of the symptoms described should at once be returned. Should the roup develop among purchased birds

and remain unnoticed until it is too late to return them, every bird purchased, even though apparently healthy, should be kept clear of the existing stock for 10–14 days. All birds badly affected should be destroyed at once, and the heads and feathers burnt. Treatment of the others should commence with a dose of Epsom salts. The mouth, nostrils, face and feathers should be washed with warm water, adding a strong disinfectant, *e.g.*, Izal. Jeyes' Fluid may be used for the face and feathers and the mouth and nostrils washed with a weak solution of tincture of iodine. The head of the bird may be dipped in weak permanganate of potash solution. Each of these treatments has been found effective, but the iodine has proved one of the most satisfactory, and in the case of swollen faces, painting with iodine tincture is often the only successful treatment. It is, however, questionable whether it is economical to save a bird with bad eye roup owing to the time lost in treatment and the ill effect upon the bird.

Good feeding and some sulphate of iron given in the drinking water are also desirable.

The chief aim of the poultry-keeper should be to prevent the introduction of roup among his fowls, and novices will do well to seek expert advice before purchasing apparently cheap birds freely advertised, and to exercise special care at this season when purchasing broody hens.

Government-owned Land in the British Isles.—*Sir Samuel Scott* asked the Parliamentary Secretary to the Board of Agriculture the number of acres of agricultural land or grass owned by the Government in Great Britain and Ireland, and in occupation of tenants, **Questions in Parliament affecting Agriculture.** and what is the average rent charged per acre?

Sir A. Griffith-Boscawen: The total acreage of agricultural land in Great Britain and Ireland under the management of the Commissioners of Woods and in occupation of tenants is 130,795 acres. This includes between 30,000 and 40,000 acres of moor land in Scotland let for sheep-grazing at 3s. per acre, and several thousand acres of down land in Sussex and Wiltshire let for very little more. The average rent of ordinary farm land is about 25s. per acre. The agricultural land, other than Crown land, owned by the Board of Agriculture and Fisheries, is 136 acres let at 31s. 7d. per acre, and 63 acres let at 41s. 3d. per acre.

The total area of land owned by the Board of Agriculture for Scotland and in the occupation of tenants is 63,405 acres, of which 5,637 acres are arable land, 4,151 acres grazings in individual occupation, and 53,617 acres common grazings. The average rent of the whole area is 1s. 3½d. per acre, but this cannot be taken as an indication of the value of the arable and grass land since a very large proportion of the area consists of mountain and heath. (11th March, 1919.)

Home-grown Wheat.—*Captain Terrell* asked the Parliamentary Secretary to the Board of Agriculture whether preference can be given to British farmers, as against imported commitments, to dispose of their corn resulting from last year's harvest?

Sir A. Griffith-Boscawen: The Board are continually bringing to the notice of the Wheat Commission the importance of using home-grown wheat to the utmost extent which is practicable, and the Commission are desirous of doing so.

The Board have been informed by the Wheat Commission that flour millers have been instructed to use as much home-grown wheat as possible in the production of flour, and at present they are using about 30 per cent. of home-grown wheat on the average, as compared with about 20 per cent. before the War. (11th March, 1919.)

Potatoes.—*Mr. Lambert* asked the Parliamentary Secretary to the Board of Agriculture if it is intended to compel farmers to grow potatoes in the coming season when they are unable to dispose of last season's crop, much of which is now being wasted?

Sir A. Griffith-Boscawen: The answer is in the negative. Farmers will have complete freedom of action during the coming season as to the crops they may wish to grow on their arable land.

Colonel Sir J. Norton Griffiths: Can the hon. Gentleman say whether the control is still on potatoes, or whether there is a free price?

Sir A. Griffith-Boscawen: A notice was issued by the Minister of Food a few weeks ago stating that control had been taken off. (10th March, 1919.)

Hops.—*Mr. Ronald McNeill* asked the Parliamentary Secretary to the Board of Agriculture if he is aware that, owing to uncertainty as to the policy of the Government in regard to the future importation of hops, anxiety exists among hop-growers as to whether it is desirable to restore the hop acreage which was grubbed during the War, and generally as to the place which hops should take in agricultural arrangements for the future; and whether he will make a statement after consultation with the Board of Trade which may serve as a guide to hop-growers in this respect?

Sir A. Griffith-Boscawen: It is proposed to retain the present control of hops for the crop of 1919. Until that crop has been disposed of the importations of foreign hops will be restricted to the amount that is shown to be necessary to provide for the quantity of beer for the brewing of which authorisation is given from time to time. I am unable to give the hon. Member at this stage any further information on the future policy of the Government with regard to foreign imports. (10th March, 1919.)

Cattle Feeding Stuffs.—*Colonel Sir A. Sprot* asked the Food Controller if he can see his way to remove at once all restrictions on the sale of feeding stuffs for cattle and pigs, including millers' offals, which are at present being charged a high price?

Mr. McCurdy: The Food Controller has already removed the restrictions on the distribution of feeding stuffs in this country. The only other restrictions imposed in connection with the sale of feeding stuffs are those set out in the Cattle Feeding Stuffs (Maximum Prices) Order,* and, in view of the importance of preventing any increase in

the prices charged, he does not yet propose to rescind this Order. I may add, however, that a temporary reduction of £2 per ton in the price of millers' offals has recently been made.

Corn Offal.—*Colonel Gretton* asked the Parliamentary Secretary to the Board of Agriculture whether he will state the respective quantities of millers' offals produced in the United Kingdom in each of the years 1915, 1916, 1917, and 1918; what proportion of these quantities was available for issue to farmers as foodstuff for live stock; and whether steps were taken to advertise throughout the country the depots or centres to which applications for the purchase of these supplies could be made?

Mr. McCurdy: I have been asked to reply. The approximate quantities of millers' offals produced in the years in question were:

1915 ..	1,820,000 tons.	1917 ..	1,727,000 tons.
1916 ..	1,820,000 „	1918 ..	719,000 „

It is impossible to state exactly the proportions of these quantities which were available for issue to farmers as foodstuff for live stock. Until the end of 1917, distribution was uncontrolled; but at the end of 1918, and until 26th January of this year, releases were arranged on a rationed basis by the Ministry of Food. As regards the last part of the question, during the period of control steps were taken to advertise freely at all markets and in trade and agricultural papers the centres to which applications should be made for permits to purchase supplies of offals. (11th March, 1919.)

Demonstration Dairy Farms.—*Lieut.-Colonel Weigall* asked the Parliamentary Secretary to the Board of Agriculture whether consideration can be given to the establishment by the Government of demonstration dairy farms managed on purely commercial lines, as examples, both on intensive arable and extensive pasture lines?

Sir A. Griffith-Boscawen: The Board are establishing ten demonstration holdings managed on purely commercial lines as examples of intensive dairy farming on arable land. The Board are doubtful whether demonstrations of dairy farming on extensive pasture lines are necessary in present circumstances, but will consider my hon. and gallant Friend's suggestion. (11th March, 1919.)

Cheese.—*Lieut.-Colonel A. Herbert* asked the Parliamentary Secretary to the Board of Agriculture whether he will consider the advisability of stimulating the production of cheese?

Sir A. Griffith-Boscawen: The Board are already doing a great deal in this direction. County education authorities are encouraged by means of special grants and other provisions to provide practical instruction in the art of cheesemaking through travelling and co-operative cheese schools, and farmers and dairymen are encouraged to use for the manufacture of cheese any milk produced in excess of what is required for human consumption. (27th March, 1919.)

Poultry.—*Captain Bouyer* asked the Parliamentary Secretary to the Board of Agriculture (1) whether His Majesty's Government have considered the extent to which the poultry industry of Great Britain may be developed as a source of food supply; whether the organisation now in existence for the promotion of the poultry industry is much inferior to that which has been set up in various foreign countries; and whether he will take steps to provide such State assistance to this industry as will enable British poultry keepers to compete successfully with foreign rivals; (2) whether he has considered, in view of the

importance of the home poultry trade, the advisability of setting up a poultry husbandry department for discharged and demobilised sailors and soldiers and others; whether, in the event of such a department being set up, steps will be taken to carry out research and educational work for large and small owners; and whether, to stimulate the home-grown poultry trade, steps will be taken to prevent foreign eggs, by marking them as such, from competing in public markets with fresh home-grown eggs?

Sir A. Griffith-Boscawen: In the reorganisation of the Board, it is intended that provision shall be made to ensure adequate representation on the staff of poultry experts, and it is proposed to establish a poultry institute for the purpose of education and research. The Board believe by these means, and by the better organisation of the industry, that British poultry keepers will be able more successfully to compete with their foreign rivals. The suggestion that foreign eggs should be marked as such is under consideration.

The Board do not propose generally to encourage discharged and demobilised soldiers and sailors, lacking in the necessary experience, to take up small holdings devoted exclusively to poultry keeping, but they are, nevertheless, anxious to encourage the more general keeping of poultry by those who take up small holdings. (31st March, 1919.)

Land Settlement of Ex-Servicemen.—*Mr. Morris* asked the Parliamentary Secretary to the Board of Agriculture the number of discharged soldiers and sailors in England and in Wales, respectively, who have applied to the various county councils and to the Board of Agriculture for land for settlement purposes; what is the total acreage represented by such applications; and what steps have been taken in England and in Wales, respectively, by the county councils and the Board of Agriculture to meet the applications?

Sir A. Griffith-Boscawen: Six thousand six hundred and thirty-five applications have been received by county councils in England and 436 in Wales. The acreage applied for is, approximately, 121,400 acres in England and 8,000 in Wales. The Board have received 441 applications for land on their land settlements. The amount of land required or arrangements to acquire which have been concluded is, approximately, 18,815 acres. Additional land is being acquired every week. (17th March, 1919.)

Agricultural Machinery.—*Mr. Hurd* asked what arrangements are in progress for the continued and most advantageous use on the land of the agricultural machinery of War Agricultural Committees as they become available for purchase; and whether special terms and priority of purchase can be offered to actual farmers and to owners who are prepared to place the outfits at the disposal of farmers in their districts?

Sir A. Griffith-Boscawen: Implements and machinery as they become surplus are being sold by public auction in the locality in which they have been at work. It is not possible to arrange for special terms to any class of purchaser, but, so far as my information goes, the purchasers have for the most part been farmers. (17th March, 1919.)

Wages of Agricultural Labourers.—*Major Howard* asked the Prime Minister whether he is aware of the discontent existing amongst agricultural labourers owing to their wages being below those prevailing in other industries, and that a strike is being organised in the Eastern Counties to occur at such a time that it will cause large areas of land to remain unsown and produce no crops this year, thereby causing heavy

loss to the community and serious unemployment during the autumn and winter months, and whether, seeing that the farmers are at present paying the highest wages the industry can bear under existing conditions, he will consider the advisability of making an early statement on agriculture, giving such guarantees as will enable the farmers to increase the wages of their men up to the level of those in other industries for similar hours?

Sir A. Griffith-Boscawen : I am aware that there is a certain amount of discontent among agricultural workers, and that in some districts threats of strikes have been made. The whole question of the present minimum rates of wages is under consideration by the Agricultural Wages Board, and I earnestly hope that both employers and workers will take all reasonable steps to avoid the disastrous consequences which any general stoppage of work on the land would involve. I hope very shortly to be in a position to make a further announcement with regard to the agricultural policy of the Government. (12th March, 1919.)

Town Sewage.—*Lieutenant Colonel Sir J. Norton Griffiths* asked the Parliamentary Secretary to the Board of Agriculture whether the Board of Agriculture have given consideration to the possibility of enlarging the food production of the country to extend land cultivation with the employment of town sewage for manurial purposes; whether the sewage of the London Metropolitan area is now disposed of under wasteful conditions and in a manner contrary to Acts of Parliament and the findings of a Royal Commission; and whether he can state the analysis and value of sewage as a manure?

Sir A. Griffith-Boscawen : The answer to the first part of the question is in the affirmative. The Board are watching closely all promising methods of using sewage as manure, and are experimenting with sewage sludge. They have been informed that the Local Government Board are not aware of any suggestion in the Royal Commission Reports that the sewage of the Metropolis should be dealt with in any particular manner, nor do the Local Government Board understand that the London County Council are acting in a manner contrary to Acts of Parliament. The system of the disposal of the sewage of the Metropolitan area is not necessarily wasteful. There are engineering and other difficulties upon which the Board are not in a position to express an opinion, but no economical scheme has yet been evolved for making use of this sewage as a fertiliser. (24th March, 1919.)

The following is a statement showing the analyses of certain sewage sludges :—

1. Sewage —

Parts per 100,000.

Type of Sewage.	Weak Domestic.	Average Domestic.	Manufacturing City.	Strong Domestic.
	Slithwaite.			Hampton.
Ammoniacal				
Nitrogen ..	1.66	3.96	2.27	9.40
Organic nitrogen	0.89	1.91	1.02	3.14
Total nitrogen ..	2.55	5.87	3.29	12.54
Suspended solids	10.70	31.10	35.00	48.50

2. Sludges—

Per cent. on Dry matter.

1905—(a) Older methods of Tank treatment,

1918—(b) Newer methods.

—	Lime Alumino- ferric Pre cipitation	Septic Tank	Slate-bed Sludge.	Activated Sludge.	Activated Sludge.
	Dorking	Leeds	Harpden	Withington	St. Albans
Organic matter	39.80	38.78	46.80	44.79	1
Inorganic matter	60.20	61.22	53.20	55.21	—
Total nitrogen	0.89	1.38	2.63	7.09	7.50
Phosphoric acid	0.66	0.66	0.34	3.75	—
Lime	23.16	9.28	—	—	—
Potash	0.07	—	0.08	—	—

3. Special Sludges (per cent.)—

—	Degreased Sludge (Grossmann process).	Degreased Sludge (Huddersfield).	"Native Guano" (Kingston), 1905.
Organic matter ..	35.5	59.8	51.25
Inorganic matter	64.5	40.2	48.75
Total nitrogen ..	1.55	1.87	1.93
Phosphoric acid ..	1.33	1.07	1.74
Lime	—	1.54	3.30
Potash	—	—	0.16

Grants to the Agricultural Organisation Society.—*Mr. Gilbert* asked the Parliamentary Secretary to the Board of Agriculture if his Department has made any financial Grants to the Agricultural Organisation Society; if so, what the amounts have been for last year and this year; if any conditions are attached to such Grants; and, if so, what the conditions are?

The following answer was circulated in reply.—The approved Grants to the Agricultural Organisation Society for the financial year 1918-19 are £7,000 from the Food Production Department, £4,000 from the Small Holdings Account, and from the Development Fund a block Grant of £5,800, together with a Grant equal to four times the amount of the Society's income from contributions from affiliated farmers' societies during 1918-19, and a Grant equal to the amount of the subscriptions received in the same period. The Agricultural Organisation Society expect to be in a position to claim approximately £20,000 in all from the Development Fund (including the block Grant of £5,800) under this arrangement; but they cannot yet tell the sum precisely. The total Grant will, therefore, be approximately £31,000. The Grants from the Development Fund are not made by the Board and are not borne on their Estimates.

The Grants for 1917-18 were £2,000 from the Small Holdings Account, and £13,240 from the Development Fund.

The conditions under which the Grant from the Development Fund was sanctioned for 1918-19 were :—

(1) That except with the consent of the Board the Society's expenditure shall not substantially depart from the estimate submitted, and that the rate of expenditure for the expenses of the governors and their attendance fees shall be subject to the approval of the Board.

(2) That the Society shall not enter upon any new scheme or extensions of work (even though their initial expenses can be defrayed from their income from the current year), which shall commit it to an increase of expenditure in 1919-20 without the previous consent of the Board.

(3) That the Grant be paid over to the Society in whole or in part at such times as may seem fit to the Board on the understanding that if the actual expenditure incurred by the Society and appearing to be reasonable and necessary is less than the amount so paid over the balance will be returned.

(4) That in carrying out this work the Society shall be careful not to interfere in any way with the work of the constituted authorities in relation to education or food production.

(5) That the Society use its best endeavours to obtain regular contributions from the affiliated farmers' societies by urging them to subscribe $\frac{1}{2}$ d. in the £ on their turnover, and also to make a levy of 6d. per member.

(6) That within a fortnight the Society submit a full Report to the Board on the steps taken to secure contributions by the affiliated farmers' societies and the results obtained.

(7) That the Board shall be represented upon the Executive Committee of the Society by two nominees.

As regards the Food Production Department Grant, the Agricultural Organisation Society are required to send monthly reports of the work done (and annual audited accounts) to the Food Production Department, while the Department hold constant conferences with the officers of the Society. (31st March, 1919.)

British Sugar Beet Growers' Society.—*Mr. Grattan Doyle* asked the Parliamentary Secretary to the Board of Agriculture whether, having regard to the pressing need for the development of production in home-grown sugar, he will state the extent to which the activities of the British Sugar Beet Growers' Society has received, and is receiving, the support of His Majesty's Government; whether the results achieved so far are satisfactory; whether sufficient land suitable for the growth of beetroot is being made available; and whether it is anticipated that the growth of the industry will lead to a substantial diminution of the pre-war import of sugar from foreign countries in the course of the next few years?

Sir A. Griffith-Boscawen: The society has received a loan from the Development Fund to purchase an estate of 5,603 acres near Newark. This loan is secured by way of mortgage on the estate. Possession was only obtained a year ago, and operations have been confined to the preparation of the estate for the growth of sugar beet and to immediate food production. The further assistance the Government will render to the development of the scheme for a commercial trial of sugar growing and manufacture in this country is at present under discussion with the society. I am not in a position to answer the latter part of my hon. Friend's question. (10th March, 1919.)

Expenditure of Board of Agriculture.—*Captain Sir Beville Stanier* asked the Parliamentary Secretary to the Board of Agriculture what were the sums voted for the Board in the years 1912-13, 1913-14, 1914-15, 1915-16, 1916-17, 1917-18, 1918-19, and the net expenditure and the surplus unexpended? (2nd April, 1919.)

The answer was circulated, and was as follows :—

---	Vote.	Net Expenditure.	Surplus Unexpended.
	£	£	£
1912-13	317,111	313,411	3,700
1913-14	309,547	264,312	45,235
1914-15	344,027	318,885	25,142
1915-16	391,748	367,752	23,996
			Deficit
1916-17	335,160	384,167	49,007*
1917-18	469,207	462,947	6,260
		Estimated	Estimated
1918-19	452,270	502,270	deficit 50,000*

* Allocated from Vote of Credit.

OFFICIAL NOTICES AND CIRCULARS.

N.B.—The Orders which may be mentioned in this section of the JOURNAL may usually be obtained at the price of 1d. each from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, and 28, Abingdon Street, London, S.W. 1; 37, Peter Street, Manchester, and 1, St. Andrew's Crescent, Cardiff.

THE following Notice was issued by the Board on 1st April :—
The prices guaranteed by the Government for 1919 grain crops are as follows :—

**Guaranteed Prices
for the 1919 Crop
of Wheat,
Barley, and Oats.**

(1) Wheat, 71s. 11d. per qr. of 480 lb.
[or 75s. 6d. per qr. of 504 lb.].

(2) Barley, 61s. 6d. per qr. of 400 lb.
[or 68s. 10½d. per qr. of 448 lb.].

(3) Oats, 44s. 1d. per qr. of 312 lb. [or 47s. 6d. per qr. of 336 lb.].

The guarantee applies to the proportion of the entire produce of each cereal normally sold; and not in respect of the proportion consumed on the farm.

It has been decided to give effect to these guarantees by means of the machinery of Part I. of the Corn Production Act, 1917. This involves payment to growers of any difference between "average prices" and guaranteed prices, on the basis of a yield per acre of 4 qr. of wheat, 4 qr. of barley, and 5 qr. of oats respectively.

It has been decided to take four-fifths in the case of barley, and two-thirds in the case of oats, as the proportion normally sold. The grower of wheat will therefore be paid for each acre four times the difference between 71s. 11d. and the average market price ascertained for the seven months commencing 1st September, 1919. The grower of barley will receive for each acre four times four-fifths of the difference between 61s. 6d., and the average price of barley similarly determined. The

grower of oats will receive for each acre five times two-thirds of the difference between 44s. 1d. and the average price of oats similarly determined.

These guarantees are subject to the provisions of Clause 2 (b) of the Corn Production Act, 1917, which states—"if it appears to the Board that any such land has been negligently cultivated, the Board may either withhold altogether the payments to which the occupier would otherwise have been entitled or may diminish the amount of those payments to such extent as the Board think proper to meet the circumstances of the case."

THE Food Controller has issued a General Licence (Order No. 284), dated 17th March, 1919, under the Live Stock (Sales) Order, 1918,*

**Live Stock
(Sales) Order, 1918:
General Licence.**

providing that notwithstanding the provisions of this Order as amended by the Order dated the 11th February, 1919, on and after the 17th March, 1919, until further notice, where in the opinion of the person grading any first-grade beast it is likely to yield an unusually small proportion of bone, the maximum prices for first-grade beasts specified in Part I of the First Schedule to the Live Stock (Sales) Order, 1918, may be exceeded by a sum of not more than 3s. per cwt. instead of 1s. per cwt., as provided by the Order.

THE Food Controller has issued a Notice under the Calves (Sales) Order, 1918,† to the effect that on and after the 31st March, 1919, the maximum price applicable upon the occasion

**Calves (Sales) Order,
1918: Notice.**

of a sale of a calf to a Government buyer shall, until further notice, be as follows —

(i) Where the calf is sold alive by dead weight, the maximum price for the calf (including the offals) shall be at the rate of 10d. per lb. of the weight of the dressed carcass.

(ii) Where the calf is sold alive otherwise than by dead weight, the maximum price shall be 15s. per calf.

(iii) Where the calf is sold dead, the maximum price shall be at the rate of 6d. per lb. of the weight of the carcass which shall include the head, skin, feet and pluck. Such price shall include the value of the offals except the paunch and intestines.

THE following Notice was issued by the Board on 28th March :—
There appears to be every probability of an increasing demand for dairy stock, and the President of the Board of

**Rearing of Heifer
Calves.**

Agriculture and Fisheries hopes, therefore, that all heifer calves that are likely to grow into good milkers will be reared. He wishes, also, to urge on breeders, especially in dairying districts, the importance of using better bulls than is usually the practice. If this is done the number of inferior calves that are now bred and slaughtered when a few days old will be greatly reduced, and a considerable increase and improvement secured in the milking herds of the country.

* See this *Journal*, June, 1918, p. 350, November, 1918, p. 1025, January, 1919, p. 1240, and March, 1919, p. 1514.

† See this *Journal*, October, 1918, p. 886, and February, 1919, p. 1374.

THE following Notice was issued by the Joint Committee of the Board of Agriculture and the Ministry of Food on 5th March :—

**Excessive Slaughter
of Calves.**

It has been brought to the notice of the Joint Committee from many sources that there is an abnormal slaughter of calves taking place, even allowing for seasonal variation. Various reasons are adduced as a cause of this excessive slaughter, but it is needless to point out that this policy continued must lead to an extreme shortage of dairy stock in the near future. The herds of all other European countries have been dangerously reduced owing to the War, and these countries will compete with the English farmer for the live stock available. In the country's interests it therefore becomes essential to reduce the slaughter to a minimum and rear as many desirable calves as possible.

THE following Notice was issued by the Ministry of Food on 21st March :—

**Feeding
of Live Stock.**

It is announced that no further certificates will be issued by the Food Controller for the purchase of oil cakes and meals, and these may now be purchased freely wherever they are available, but whenever supplies are not equal to all the demands, purchasers requiring them for milch cows will be given a preference. Except as regards the manufacture of malt, there is no longer any restriction on the use of barley, and no licence is required for the feeding of damaged grain. Dredge corn may be fed for any purpose, and horses are not now restricted in the quantity of oats, maize, beans and of the other cereal foodstuffs (practically everything except wheat) that may legally be fed to them. Millers' offals are now available in greater quantity and of better quality and may be obtained from the London mills in lots of not less than 1 tons at £14, for fine and £13 per ton for coarse offals,* including delivery to buyer's nearest railway station, sacks extra, on early application to the Feeding Stuffs Section, Ministry of Food, New County Hall, S.E. 1.

THE following Notice was issued by the Ministry of Food on 26th March :—The Food Controller has suspended, as from the 1st April, the maximum prices fixed for :—

**Reduced Prices
of Cakes and Meals.**

Home manufactured cakes and meals;
Imported cakes and meals;
Compound cakes and meals;

with the exception of all classes of cotton and linseed cakes and meals, in connection with which the question is still under consideration.

The Food Controller, however, wishes it to be understood that if prices rise above reasonable limits, he will reimpose immediately the original or reduced maximum prices. The Requisition Order has also been suspended in respect of cakes and meals, except cotton and linseed, and importing firms may, therefore, purchase and import these articles freely from abroad.

The Food Controller has made arrangements to sell the whole of the Government stocks of seeds, nuts and kernels to the crushers of the United Kingdom on such terms as will permit of a substantial reduction in the price of home-produced cattle cake at an early date.

* These prices have since been reduced, see notice on p. 100.

THE Ministry of Food state that on and from 24th March, 1919, the maximum prices for London Flour Mill offals, carriage paid, are reduced by 40s. per ton for offal in bulk and in lots of two tons or over, *ex mill*. Coarse offals will, therefore, be £11 per ton, and fine £12.

Millers have been instructed to charge all deliveries of offals on and from the date given in accordance with the above, and it will, therefore, be possible to purchase requirements to better advantages locally. The decrease in price is made with the object of clearing the present surplus, after which the price will be advanced.

THE Ministry of Food have stated that the following amounts may be added to the maximum prices of feeding stuffs to cover cost of bags :—

Home Manufactured Cakes and Meals.—20s. per ton if 20 bags to the ton, and so in proportion according to the number of bags per ton used.

Millers' Offals.—*Returnable Sacks, net weight.*—2s. 6d. each; this amount to be refunded on all sacks returned to the miller in good condition within 3 months of date of the miller's invoice.

Non-returnable Sacks, Gross Weight.—25s. per ton if containing 1 cwt. or less, and 20s. per ton if containing more than 1 cwt.

Other Cattle Feeding Stuffs.—25s. per ton if 20 bags to the ton, and so in proportion according to the number of sacks or bags used per ton.

Imported.—The charges for bags containing home-manufactured feeding stuffs are not applicable to imported stuffs. The maximum prices for imported feeding stuffs are inclusive of bags, and the Order directs that they must be sold, sacks included, gross weight.

All other terms and conditions affecting dealer rebates, terms of payment, discounts, additions on small sales, and charges for transport are unchanged.

VERY satisfactory results have recently attended the rearing of pullets at the Anglesey Incubating Station.

Egg-laying Results at the Anglesey Incubating Station. The following are the trap nest records of 29 White Wyandotte pullets taken during the period 15th October, 1918, to 15th January, 1919 :

No. of Pullet.	Eggs laid.	No. of Pullet.	Eggs laid
30 ..	27	45 ..	56
31 ..	51	46 ..	34
32 ..	23	47 ..	49
33 ..	39	48 ..	63
34 ..	41	49 ..	35
35 ..	34	50 ..	43
36 ..	18	51 ..	38
37 ..	36	52 ..	44
38 ..	44	53 ..	54
39 ..	51 (died Dec.).	54 (sold in November).	
40 ..	56	55 ..	47
41 ..	45	56 ..	33
42 ..	49	57 ..	52
43 ..	39	58 ..	38
44 ..	46		

These birds are of medium size, hardy, and of good strain, and were all bred and reared at the Station.

Every autumn about 30 pullets most suitable for breeding purposes are selected, and those which after trial prove most satisfactory are retained for at least two seasons. The conditions of housing and climate under which the birds are reared are not very satisfactory, the housing being of the scratching shed type with insufficient light and space, and the grass pens into which as a consequence the birds have to be released during the day being much exposed to the high winds and wet experienced by the Island during the winter months. Nevertheless, it will be seen that during 13 weeks of late autumn and winter the pullets laid on an average 12 eggs, and one pullet in every four laid more than 50 eggs.

THE following Circular Letter was addressed to Agricultural Executive Committees by the Food Production Department of the Board on 31st March :—

**Training and Placing
in Employment of
Ex-Service Men who
desire to obtain
Agricultural Work.**

SIR, —I am directed by the President of the Board of Agriculture and Fisheries to invite the cordial co-operation of your Committee in the measures to be taken to train ex-Service men without previous experience in agriculture, who are willing to take work on the land, whether with a view to obtaining ultimately holdings of their own or not.

2. It is expected that in view of the shortage of labour on the land Committees will be able to get some of the men placed with farmers at once at the agricultural wage of the district even though they are unskilled. In other cases it will be necessary to give the men a certain amount of training in the ordinary manual operations of a farm. The training will be designed to give to unskilled men practical experience to enable Committees to secure them employment on the land as wage earners. The Board do not think that it is practicable to attempt to provide the long course of training which would be necessary to fit an unskilled man to become a small holder, especially in view of the fact that it would be impossible to guarantee to provide holdings for all the men who might be trained immediately their training had been completed. The Board think, therefore, that unskilled men should, in the first instance, obtain employment as wage earners.

3. It is hoped that some of the men needing training will receive it under the Army Education Scheme before they are demobilised, and further particulars of any such scheme will be forwarded to Agricultural Executive Committees in due course. There will remain, however, a number of men for whom training facilities must be provided after their return to civil life. The Board propose to set up training centres as required in various parts of the country, each centre to serve one or more counties. The Board will be glad if Committees will co-operate with them in the establishment of the training centres required, and will forward at an early date particulars of any premises in their county that are considered to be suitable to be used as training centres, and are available for this purpose. In some instances farms in the occupation of the Committee may be suitable to be used for training purposes, and where insufficient accommodation is available the Board will endeavour to arrange the provision of Army hutments.

4. The arrangements for dealing with men under the scheme are described in detail in the accompanying Memorandum (F.P. 469 L. 6*) and need not, therefore, be repeated here. The Ministry of Labour are notifying Employment Exchanges that particulars of ex-Service men requiring agricultural employment should be referred to the County Agricultural Executive Committee. Your Committee should also obtain from the County Council and County Borough Councils (who have been sent details of the scheme) particulars of men who have applied on the Form L.S. 8A, (from the booklet L.S. 8) for cottage or small holdings and have had no previous experience of agriculture. Such men already demobilised should be communicated with immediately with a view to their being assisted in finding employment and needed training.

5. Committees will doubtless proceed to compile lists of farmers and market gardeners in the county who will be willing to engage ex-Service men. Committees will appreciate the desirability of placing these men with good farmers representative of the different forms of agriculture practised in the county who will be in sympathy with the men and make them as comfortable as possible. The Board feel sure that Committees may rely on farmers responding to the appeal that should be made to them on patriotic grounds as well as in their own interest to assist in this national duty of providing an opportunity for ex-Service men to secure an open-air life.

6. In order to assist Committees in this matter, arrangements have been made to send under a separate cover the returns on the Form A. 218/s. that were obtained by the Board in March last, showing the additional labour required by farmers in the county.

I am, etc.,

(Signed) A. D. HALL,
Secretary.

ENCLOSURE.

1. Particulars of ex-Service men requiring agricultural employment will be obtained by Agricultural Executive Committees through the Employment Exchanges in accordance with the arrangements suggested in paragraph 5 of C.L. 161/L. 2, dated the 14th January last.† Men may also be referred to the Committee by the County or Borough Councils on receipt of the Form L. S. 8A (Application for Small Holding or Cottage Holding).

2. Committees should take steps to interview each applicant for employment with a view to ascertaining his previous experience and qualifications. Where the applicant had already had some experience of farm work or is otherwise qualified, Committees may be able to arrange with the Exchange for him to be placed at once at the full agricultural wage of the district, with an employer in need of labour.

3. Otherwise the applicant, if suitable, should be sent to a training centre as soon as possible in order to be given tuition in the ordinary manual operations of a farm, to enable him to be placed with a farmer at the full wage of the district. One training centre may be sufficient to serve more than one county, the County Committees making mutual arrangements as to the number of trainees to be sent from each county. The Board hope that in connection with most of the training centres it will be possible to arrange that they be under the management of the

* See below.

† Printed in this *Journal*, February, 1919, p. 1369.

Agricultural Executive Committee of the county in which they are situated. The period of tuition should normally be not more than six to eight weeks.

4. During the period of training the men will be entitled to a sum of 30s. a week, less 17s. 6d. for the cost of board and lodging, if they are accommodated and fed at the centre. Married men and men with dependants wholly dependent upon them may claim a subsistence allowance of 2s. 6d. per day while at the centre if they are compelled to live away from home, and men with dependants partially dependent upon them a subsistence allowance of 1s. 6d. per day. Claims should be made on the Form F. P. 466/L. 6, and Committees are authorised to pay this extra allowance where the claim is properly certified and they have no reason to doubt its accuracy.

5. Committees sending men to a training centre in a neighbouring county should not pay their subsistence allowances, but after seeing that Form F. P. 466/L. 6, is properly filled up, should send it to the Committee in whose county the training centre is situate, so that all payments to the men may be made by that Committee.

6. Seven days before a trainee is likely to be passed out of the training centre the Principal should notify the Committee concerned who will thereupon make arrangements for the placing of the man in employment, and for another man awaiting training to fill the vacancy at the centre. Every man dealt with should be registered at the nearest Employment Exchange so as to receive the unemployment donation if employment cannot immediately be found for him and he is entitled to this donation. Every effort should be made to place men in the branch of farming they desire to take up, especially in the case of those men who desire ultimately to work holdings of their own. Committees should also take steps to bring to the notice of the men any agricultural educational courses that are available in the county.

7. *Tractor School.*—A School for the training of ex-Service men in tractor driving (as well as other farm work) has been established at Bois Hall, near Brentwood, Essex. Men who desire to learn tractor driving in addition to ordinary farm work will be received at this School. Committees should communicate with the Board, giving the name of each man they desire should be given such training, and the Board will inform Committees of the date when he can be received at the School. On completion of training, the men will be returned to the Committee concerned who will arrange for their employment in the county.

8. *Travelling.*—Free Government railway tickets will be issued by the Employment Exchanges on the application of the Agricultural Executive Committee for the journey by railway of an ex-Service man trained under this scheme, either to or from the training centre or to his employment. Every effort must be made to reduce such travelling to a minimum.

9. *Accommodation.*—Farmers notifying their willingness to take ex-Service men into their employment should be asked to state what accommodation is available, so that the men may be informed of this before they are sent out.

10. *Accounts.*—The following instructions will be applicable to Committees in whose county a training centre is established :—

(a) Where the general balance from all sources in the Committee's hands is insufficient to meet outgoings, funds should be requisitioned from the Board in the usual way.

(b) A separate service account, entitled "Training of Ex-Service Men," should be opened in the Committee's quarterly accounts rendered to the Board. Expenditure should be classified under the following heads: (i.) Wages of Instructors; (ii.) Wages of Trainees; (iii.) Subsistence Allowances; (iv.) Maintenance of Trainees; (v.) Upkeep of Implements, etc.; (vi.) Fodder, Fuel and other Supplies; (vii.) Miscellaneous.

(c) Payments in connection with a training centre should, as far as possible, be made by the Treasurer of the Committee, the bills being first certified by the Principal of the centre. The latter should only pay such bills as need to be discharged locally in cash. For the purpose of these local cash payments, the Principal should be furnished from time to time with imprests for which he should account to the Committee at regular intervals.

THE following Circular Letter (No. C.L. 130/C. 1) was addressed to Agricultural Executive Committees by the Food Production Department of the Board on 13th March:—

**Agricultural
Executive Committees
and Cultivation of
Land Orders.**

SIR,—The serious difficulties with which farmers are faced at the present time owing to the shortage of labour and to the fact that farm work is greatly in arrear in consequence of the unfavourable weather, render it undesirable in the opinion of the Board for Committees to attempt to secure any further increase in the existing arable area for the harvest of this year. For the same reasons it is desirable, from an agricultural standpoint, that farmers should be allowed complete freedom to cultivate their arable land with the crops that may best suit their particular conditions. Moreover, the Board are of opinion that, subject to the cultivation of land according to the rules of good husbandry, complete freedom of cropping is now compatible with the public interest, for the extensive acreage of wheat sown in the United States last autumn and the favourable reports on the present condition of the American crop justify the expectation that in the cereal year 1919-20 the supply of bread-stuffs will suffice to meet the demand of the world's markets.

While permitting freedom of cropping, Committees should urge upon farmers the need for cleaning their land and for providing winter food for live stock, so that during the coming winter the supplies of meat and milk may be kept up, and an endeavour made to convert the abundant straw crops into manure. It should be recognised that while the cereal position for 1919-20 is satisfactory, it is impossible to forecast the future, and it is not unlikely that next year it may again be necessary to ask farmers to devote attention to the growing of corn.

In the present circumstances, however, I am directed by Lord Ernle to ask that those Committees who have served Orders requiring farmers to cultivate specified areas with particular crops will issue at once a public notice that all their Orders are withdrawn except those which have been served in the interests of good husbandry, and that for the present season farmers have a free choice as to the crops to be grown on their land. The Committees should still take any necessary action to deal with cases of bad farming, but good farmers who are cultivating their land in accordance with the rules of good husbandry should for the present season be free of control by the Committees.

I am, etc.,

(Signed) F. L. C. FLOUD, *Assistant Secretary*.

THE following Circular Letter (No. C.L. 68/H.) was addressed to County Councils in England and Wales by the Board on 10th March :—

**The Organisation
of Horticultural
Instruction.**

SIR,—The Board have had under consideration the question of the methods that should be adopted in future to provide technical advice and instruction to small

holders and allotment holders throughout the country.

As the Council are aware Horticultural Sub-Committees of the Agricultural Executive Committees were established during the War as one of the emergency measures in connection with the Food Production campaign. Many of these sub-committees have accomplished a considerable amount of valuable work, but now that the War is over the Board think that the whole question of horticultural instruction should be put on a permanent basis. The importance of adequate provision being made for instruction of the kind has been emphasised by the decision of the Government to provide facilities for ex-Service men to settle on the land.

The experience which the Board have gained during the War shows that there is a great field of useful and necessary work to be done in improving the methods of small cultivators and in assisting them to obtain the best possible return for their labour. The improvement of orchards and fruit plantations, the demonstration and choice of the most profitable crops for small holders, and the selection of the varieties most suitable for marketing, the encouragement of bee-keeping and instruction in the management of poultry and small live stock are instances of some of the directions in which more educational work is greatly needed.

It appears to the Board that in order to deal effectively with these and other similar questions it is essential that there should be a special committee in each county composed of men and women who are prepared to give time and attention to the needs of small growers, and that this committee should have an adequate staff of horticultural instructors at their disposal. This committee should obviously be associated with the Local Education Authority of the county in order that it may obtain a fair share of the funds that are available.

I am directed therefore to express the hope that your Council will take steps at once to set up a special Horticultural Sub-Committee of the committee responsible for agricultural education, whose duty should be to undertake the care of the interests of the small growers in the county and to draw up for submission to the Education Committee schemes for providing any horticultural advice and instruction that may be needed. The questions affecting small growers are so numerous and the work of catering for their needs is so detailed that the Board do not think the matter can be dealt with adequately unless a special sub-committee is appointed for the purpose.

If a sub-committee on the lines suggested in this letter is set up by your Council the Board will take the necessary steps to dissolve the Horticultural Sub-Committee of the Agricultural Executive Committee in order that the new committee may carry on their work. The Board desire to express the very strong hope, however, that provision will be made by the Council to co-opt on the new sub-committee members of the existing Horticultural Sub-Committee so as to retain the services of all those who have done useful work.

I am, etc.,

(Signed) A. D. HALL, *Secretary*.

THE following Notice was issued by the Food Production Department of the Board on 14th March :—

Wart Disease of Potatoes.

In view of the serious menace to the potato crop caused by the spread of Wart Disease the Board of Agriculture and Fisheries have been obliged, for the protection of growers, to issue the Wart Disease of Potatoes (Scottish Seed Potatoes) Order of 1919. Sellers of seed potatoes are urged to pay careful attention to its provisions in the public interest.

Under this Order no person is allowed to bring or cause to be brought into England or Wales any seed potatoes grown in Scotland unless (a) the potatoes are of a variety that has been approved by the Board of Agriculture and Fisheries as immune from Wart Disease, or (b) unless he has previously obtained a declaration signed by the grower of the potatoes that to the best of his knowledge and belief the potatoes are not affected with Wart Disease and that Wart Disease has not occurred on the farm where the potatoes were grown. He must also obtain a certificate from the Board of Agriculture for Scotland, issued not more than seven days before the date of consignment of the potatoes, that Wart Disease has not existed on or within one mile of the said farm.

Seedsmen should specially note that the Order applies to all Scottish seed potatoes sold by them after the commencement of the Order (except those of approved immune varieties) no matter when the potatoes were purchased and consigned.

Failure to obtain the declaration and certificate, or to produce them for inspection if required by an officer of the Board, renders the offender liable to a penalty not exceeding £10.

Copies of the Order and of the list of varieties approved by the Board as immune from Wart Disease may be obtained on application from the Board's Office at 72, Victoria Street, London, S.W. 1.

THE following Notice was issued by the Food Production Department of the Board on 14th March :—

The Women's Land Army.

The demand for women labour is increasing, and immediate steps are being taken to recruit and train a further supply. This recruiting will be facilitated by the fact that it has been decided to raise the minimum wage for women of the Land Army by 2s. 6d. a week. They will now receive 22s. 6d. for the first three months' agricultural work, which includes the period of training, and afterwards 25s. a week as the minimum wage, or as much more as can be earned under the Wages Board award. This advance will take effect on 28th April.

AN Agricultural Costings Committee has been set up jointly by the Board of Agriculture and Fisheries for England and Wales, the Board of Agriculture for Scotland, the Department of Agriculture and Technical Instruction for Ireland, and the Ministry of Food. The objects of the Committee will be to obtain such information as to the costs and results of farming as is required by these Departments and the Agricultural Wages Boards and Committees.

The Committee will be executive, and will initiate such schemes as it considers necessary, making use for this purpose of the Costings Branch of the Ministry of Food, the Institute for Research in Agricultural Economics at Oxford, the Agricultural Faculty of the Royal College of Science for Ireland, and any other existing organisations which may be found convenient for the purpose of obtaining information. The Committee will report to the Ministers of the four Departments concerned, but the Minister of Food will answer to Parliament on its behalf. The Committee is constituted as follows :—

Ministry of Food.—Mr. W. H. Peat (*Chairman*), Lord Bledisloe, Mr. E. F. Wise, Mr. W. Anker Simmons, Mr. C. B. Fisher, Mr. A. P. Macdougall.

Board of Agriculture and Fisheries.—Sir Henry Rew, Hon. E. G. Strutt.

Board of Agriculture for Scotland.—Sir Robert Greig, Mr. P. A. Francis.

Department of Agriculture and Technical Instruction for Ireland.—Mr. J. R. Campbell, Dr. Hinchcliff.

Institute for Research in Agricultural Economics, Oxford.—Mr. C. S. Orwin.

Consumers' Council.—Mrs. Reeves, Mr. R. B. Walker.

Central Agricultural Advisory Council.—Mr. E. W. Langford, Mr. A. Batchelor.

Irish Agriculturists.—Colonel Sir Nugent Everard, Bart.

Acting Secretary.—Miss Powell, New County Hall, Westminster Bridge Road, London, S.E. 1.

THE Food Controller has decided to remove all the present restrictions on the sale and distribution of live stock for slaughter on 30th September, 1919, the date up to which prices to farmers have already been announced.

Removal of Live Stock from Control.

THE Food Controller has decided to issue a General Licence under the Cream Order, 1918, which will allow, during the present flush of milk, cream to be used, sold, supplied, or acquired free from the restrictions imposed by that Order.

Cream Restrictions Removed.

The General Licence was to come into operation on 12th April, 1919; it will be withdrawn whenever conditions render such a course desirable.

THE Army Council has issued an Order cancelling the Orders at present in force regulating the sale of wool. This Order has the effect of removing the restrictions on the sale of home-grown wool, and farmers are, therefore, free to make their own arrangements for the disposal of the 1919 clip.

Sale of Wool.

A dispute arose last December between the employers of agricultural labour in Chatteris, Cambridgeshire, and their workers as regards the rate of wages to be paid, and a strike was threatened. After some negotiation the two parties agreed in January to submit the dispute to an arbitrator to be appointed by the President of the Board of Agriculture and Fisheries. Sir Charles Longmore, K.C.B., was nominated, and after hearing the arguments put forward on either side made his award, which is in the following terms :—

**Wages Award to
Agricultural
Labourers
in Chatteris,
Cambridgeshire.**

regards the rate of wages to be paid, and a strike was threatened. After some negotiation the two parties agreed in January to submit the dispute to an arbitrator to be appointed by the President of the Board of Agriculture and Fisheries. Sir Charles Longmore, K.C.B., was nominated, and after

The wages or remuneration which shall be paid or allowed by an employer in the Parish of Chatteris who, on 17th January, 1919, had failed to agree with any of the following employees a rate or scale of wages or remuneration to be paid or allowed to such employee, shall from 17th January, 1919, until the commencement of the corn harvest in 1919 be as follows :—

I. General Labourers and Yardmen.—

- (1) The wages payable for employment in agriculture of male general labourers and yardmen of 18 years of age and over shall be at the rate of 42s. for a week of 48 hours.
- (2) The differential rates for overtime shall be as follows :—
 - (a) In respect of overtime employment on weekdays, 1s. 1½d. per hour.
 - (b) In respect of overtime employment on Sundays, 1s. 4d. per hour.
- (3) For the purpose of the application of the above rates the following employment is defined as overtime employment, that is to say :—
 - (a) All employment in excess of 48 hours in any week (excluding Sunday).
 - (b) All employment on a Sunday.
- (4) For the purpose of the above rates the hours of work shall not include meal times, but shall include any time during which by reason of weather conditions an employer has prevented from working a workman who was present at the place of employment and ready to work.

II. Horsekeepers and Cowmen.—

- (1) The wages payable for employment of any male workman of 18 years of age and over employed wholly or mainly as a horsekeeper or cowman shall be at the rate of 50s. a week for a week consisting of the hours of employment, whether on weekdays or on Sunday, customary in the Parish of Chatteris in the case of a workman so employed.
- (2) The differential rates for overtime shall be as follows :—
 - (a) In respect of overtime employment on week days 1s. 3½d. per hour.
 - (b) In respect of overtime employment on Sundays 1s. 7d. per hour.
- (3) For the purpose of the application of the above rates all employment customary in the Parish of Chatteris is hereby defined to be overtime employment.

- (4) For the purpose of the above rates the hours of work shall not include meal times, but shall include any time during which by reason of weather conditions an employer has prevented from working a workman who was present at the place of employment and ready to work.

III. Rootmen.—

- (1) The wages payable for employment as a rootman of 18 years of age and over shall be at the rate of 11s. a day of eight hours.
- (2) The differential rates for overtime shall be as follows :—
- (a) In respect of overtime employment on weekdays 1s. 8½d. per hour.
- (b) In respect of overtime employment on Sundays 2s. 0½d. per hour.
- (3) For the purpose of the application of the above rates the following employment is defined as overtime employment, that is to say :—
- (a) All employment in excess of eight hours in any weekday.
- (b) All employment on a Sunday.
- (4) For the purpose of the above rates the hours of work shall not include meal times, and shall not include any time during which by reason of weather conditions a rootman is unable to work.

IV. Threshing Men.—

- (1) The wages payable for employment as a threshing man of 18 years of age and over shall be at the rate of 12s. per day of eight hours.
- (2) The differential rates for overtime shall be as follows :—
- (a) In respect of overtime employment on weekdays 1s. 10½d. per hour.
- (b) In respect of overtime employment on Sundays 2s. 3d. per hour
- (3) For the purpose of the application of the above rates the following employment is defined as overtime employment, that is to say :—
- (a) All employment in excess of eight hours in any weekday.
- (a) All employment on a Sunday.
- (4) For the purpose of the above rates the hours of work shall not include meal times, and shall not include any time during which by reason of weather conditions a threshing man is unable to work.

The provisions of the Order of the Agricultural Wages Board, dated 6th September, 1918, as to benefits and advantages which may be reckoned as payment of wages in lieu of payment in cash, and of the determinations of values of "Benefits and Advantages" in part payment of minimum rates of wages fixed for Cambridgeshire, Huntingdonshire, and Bedfordshire (A.W. 333) shall apply to cases arising under this award.

**Revocation of Statutory
Rules and Orders
affecting Farmers.**

THE following Orders have recently been
revoked by the Food Controller:—

No. of Order.	Title of Order.	Page of <i>Journal</i> in which Order was Published.
No. 22 of 1918 ...	The Deer (Restriction of Feeding) Order, 1918.	February, 1918, p. 1319.
No. 402 of 1918...	The Growing Grain Crop Order, 1918.	July, 1918, p. 482.

Claughton-on-Sea.—Hd. J. Keeble, Great Oakley Hall, for unlawfully using wheat for feeding poultry, was fined £108.

**Prosecutions
of Farmers under
Statutory Rules and
Orders.** *Edinburgh*.—Thomas Stewart, grain merchant, of 2, Mornington Place, was charged with making a false statement to two Grain Officers of the Ministry of Food in connection with an application for a licence for the use of dredge corn as animal food. The defendant produced to the officers a sample of dredge corn in a wet and damaged condition, and alleged that it was in this condition when he got the sample from the tenant of Burnwynd Farm, Kirknewton. The tenant and her son gave evidence to the effect that all the corn was dry and in good condition. The Sheriff said it was a bad case and imposed a fine of £25.

Strood.—John Edward, Jun., dairy farmer, Great Clayne Farm, Chalk, near Gravesend, was charged on three summonses with selling milk in excess of the maximum price to G. Barden, and three with entering into a fictitious transaction for the sale. There were six other summonses of a similar nature with reference to supplies of milk to R. A. Munn. On the invoices delivered to Barden and Munn the maximum price was stated, but extra payments were made to the defendant for the supplies. The public were not charged more in consequence, and Barden and Munn paid the extra amounts for the reason that they could not otherwise obtain milk. On the twelve summonses the defendant was fined £24, with £7 10s. costs. (*National Food Journal*, 12th March, 1919.)

NOTICES OF BOOKS.

Co-operation for Farmers.—Lionel Smith-Gordon (London: Williams and Norgate, 1918, 6s. net). This book seeks to supply the necessary information to those considering the foundation of co-operative societies. The co-operative system is defined and an account given of its historical development. Other chapters deal with the application of co-operation to agriculture and the various types of societies. Attention is also given to the examples afforded by co-operation in Denmark, Germany, Ireland and the United States. An extensive bibliography is appended.

The Farm Tractor Handbook.—George Sherwood (London: Iliffe & Sons, Ltd., 1918, 5s. net).—The aim of this book is to assist the farmer in choosing from the increasing number of makes on the market a type

of tractor suitable to his conditions. It explains in simple language the general mechanism of these machines and their various parts. Chapters are devoted to Starting and Repairs, Different Types of Tractors, and Ploughing and Belt Work. A list is also given of tractor makers and agents in the United Kingdom.

The Development of English Agriculture and Rural Life.—Arthur W. Ashby and Mabel K. Ashby (London: National Home-reading Union Pamphlets, Science Series, No. 1, 1s.).—This pamphlet deals with the decline of British agriculture during the latter part of the Nineteenth Century and the defects in the system of agricultural employment, etc. It outlines the policy adopted during the War to combat the food shortage and to stimulate production. The latter part of the pamphlet is devoted to a discussion of the future influence of the Corn Production Act on agriculture generally, the wages, education and status of the agricultural worker, and the development of rural organisation, housing and social life.

The World's Meat Future.—A. W. Pearce (Sydney [Australia], John Andrew & Co., 1918, 10s. 6d.).—This book commences with a general analysis of the present position and future outlook as regards meat supplies throughout the world. Subsequent chapters are devoted to all the important meat producing countries, and, in addition to the various branches of the industry under consideration, attention is given to stock breeding and raising.

MISCELLANEOUS NOTES.

THE *International Crop Report and Agricultural Statistics* for March, 1919, published by the International Institute of Agriculture, gives

Notes on Crop Prospects and Live Stock Abroad.

particulars concerning the production of the cereal crops in certain countries in the Northern Hemisphere. *Wheat*.—The production in Germany, Denmark, Spain, France, United Kingdom, Italy, Luxemburg, Norway, Netherlands, Sweden, Switzerland, Canada, United States, British India, Japan, Egypt, Morocco, and Tunis is estimated at 295,127,000 qr. in 1918, against 239,836,000 qr. in 1917, or an increase of 23.1 per cent. *Rye*.—The estimated production in Germany, Denmark, Spain, Ireland, Italy, Luxemburg, Norway, Netherlands, Sweden, Switzerland, Canada, and United States is placed at 57,873,000 qr. in 1918, or an increase of 21.3 per cent. compared with 1917, when it amounted to 47,717,000 qr. *Barley*.—The production in Germany, Denmark, Spain, United Kingdom, Italy, Luxemburg, Norway, Netherlands, Sweden, Switzerland, Canada, United States, Japan, Egypt, Morocco, and Tunis is estimated to amount to 92,493,000 qr. in 1918, against 81,728,000 qr. in 1917, or an increase of 13.2 per cent. *Oats*.—It is estimated that the total yield in Germany, Denmark, Spain, United Kingdom, Italy, Luxemburg, Norway, Netherlands, Sweden, Switzerland, Canada, United States, Japan, Morocco, and Tunis amounts to 295,123,000 qr. in 1918, against 281,912,000 qr. in 1917, or an increase of 4.7 per cent. *Maize*.—The production in Spain, Italy, Switzerland, Canada, United States, Japan, and Morocco is estimated at 313,545,000 qr. in 1918, against 371,466,000 qr. in 1917, or a decrease of 15.6 per cent.

Sowing of Winter Cereals in the Northern Hemisphere.—The areas estimated to have been sown with winter *wheat* in 1918-19, compared with the areas sown during the corresponding period of 1917-18, expressed as percentages, are as follows:—Denmark 89, France 98, England and Wales 96, Canada 95, United States 116, British India 69, Japan 93; with *rye*:—Denmark 103, France 93, England and Wales 95, United States 102; with *barley*:—France 103, Japan 108; with *oats*:—France 97.

France.—The area under winter wheat is officially estimated at 11,087,000 acres, against 11,266,000 acres last year, and 9,432,000 acres in 1917. A normal pre-war wheat acreage was about 16,000,000 acres, nearly all of which was winter wheat. (*Broomhall's Corn Trade News*, 28th March, 1919.)

According to a report published by the Ministry of Agriculture on 5th April, the condition of the crops on 1st March was as follows (figures for March, 1918, in brackets):—Winter wheat 69 (72); winter barley, 70 (71); winter oats, 68 (71); and rye, 70 (73). (80 = good, 60 = fair.) (*Broomhall's Corn Trade News*, 7th April, 1919.)

United States.—According to a report issued on the 8th April by the Statistician of the Department of Agriculture, the average condition of winter wheat and rye in the United States on the 1st April was estimated as follows:—Wheat, 99·8 per cent., compared with 98·5 per cent. in December last, and 78·6 per cent. a year ago; and rye, 90·6 per cent., compared with 85·8 per cent. a year ago. The total yield of wheat is estimated at 837,000,000 bush. against 558,449,000 bush. last year, and rye at 101,000,000 bush. compared with 89,103,000 bush. (*The London Grain, Seed and Oil Reporter*, 8th April, 1919.)

India.—The second official estimate of the acreage sown with wheat in India in 1918-19 is 23,733,000 acres, compared with 23,472,000 acres in the first estimate this season and 33,497,000 acres the final estimate for 1917-18. (*Broomhall's Corn Trade News*, 27th March, 1919.)

According to the second official forecast issued on the 11th March, the area sown with rape and mustard, as reported up to date, is estimated at 2,930,000 acres compared with 3,933,000 acres in 1917-1918, and that sown with linseed 1,841,000 acres compared with 2,932,000 acres. (*The London Grain, Seed and Oil Reporter*, 9th April, 1919.)

South Africa.—According to the preliminary estimate, the acreage sown with maize was 2,948,900 acres as compared with 3,298,546 acres last year, and the yield is estimated at 4,015,250 qr. against 3,998,840 qr. in 1918. (*The London Grain, Seed and Oil Reporter*, 31st March, 1919.)

Live Stock in France.—The numbers of stock on the 30th June, 1918, were as follows (the corresponding numbers on the 1st July, 1917, being shown in brackets):—Cattle, 13,314,856 (12,443,304); sheep, 9,496,315 (10,586,594); pigs, 4,020,897 (4,200,280). (*International Crop Report and Agricultural Statistics*, March, 1919.)

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales, state that the wet weather and frosts which prevailed during March, have everywhere hindered growth of the crops. Wheat is satisfactory on dry soils, particularly if sown early, but elsewhere it has suffered some damage and its condition is hardly up to the average generally. The area under wheat appears to be less than last year by some 10 per cent. Winter oats and

**Agricultural
Conditions in England
and Wales
on 1st April.**

beans appear to have withstood the unfavourable weather better, and they mostly present a more favourable appearance.

Spring cultivation and sowing have been nearly at a standstill during the month, except on light and dry ground, where a certain amount was done. Work is consequently much in arrears—by a fortnight or more in most places. Scarcely any potatoes have been planted, except a few earlies here and there; and in many districts no preparation of the ground for this crop has yet been begun.

Seeds are very often patchy and backward; a certain amount of damage appears to have been done and some fields are being re-ploughed; they are hardly so promising as a month ago.

Lambing is now general all over the country, except in the hill districts. Reports are very uniform: ewes are in relatively poor condition; the fall of lambs is about up to the average, though poorer reports are to hand from a few neighbourhoods; and mortality, especially among lambs, is somewhat heavier than usual owing to the unfavourable weather.

Skilled labour of all kinds is still scarce, and but little improvement can be noted during the month, although the demand has not been so heavy as is usual during March, owing to the weather preventing work in the fields.

The following local summaries give further details regarding agricultural labour in the different districts of England and Wales:—

**Agricultural
Labour in
England and Wales
during March.**

Northumberland, Durham, Cumberland and Westmorland.—The supply of labour is still deficient, particularly skilled men, but the shortage has not been very keenly felt owing to the unfavourable weather.

Lancashire and Cheshire.—The supply of labour is still short, especially skilled hands.

Yorkshire.—There is a marked shortage of horsemen, and other skilled labour is also somewhat deficient; otherwise the supply meets the farmers' requirements.

Shropshire and Stafford.—The supply of labour is very scarce, and generally the deficiency appears to be as great as ever it has been.

Derby, Nottingham, Leicester, and Rutland.—Skilled labour is particularly deficient. Conditions appear to be getting a trifle easier, but the demand for labour is not yet so great as usual at this time of year.

Lincoln and Norfolk.—The situation has somewhat improved, and, owing to work having been retarded by the wet weather, the supply of labour has proved sufficient for requirements in some districts, but generally there is still a deficiency, horsemen being often difficult to obtain.

Suffolk, Cambridge and Huntingdon.—Occasionally the supply of labour is sufficient for requirements, but generally it is still deficient, horsemen and cattlemen being particularly scarce.

Bedford, Northampton, and Warwick.—Labour is generally sufficient but there is an urgent need of horsemen and cattlemen.

Buckingham, Oxford, and Berkshire.—There is still a shortage of skilled labour of all kinds, which will be more severely felt when the weather improves.

Worcester, Hereford, and Gloucester.—The supply of labour is somewhat easier, but there is still a shortage, especially of skilled men.

Cornwall, Devon, and Somerset.—There is still a shortage of labour, particularly of horsemen and cattlemen, and wages are rising.

Dorset, Wiltshire, and Hampshire.—The supply of labour is still short, but there are indications of some improvement, and under the past weather conditions the supply has been about sufficient to meet requirements.

Surrey, Kent, and Sussex.—Owing to farm work having been delayed by the weather, the supply of labour has been sufficient for requirements in some districts, but generally there is a shortage, horsemen sometimes being difficult to obtain.

Essex, Hertford, and Middlesex.—Usually a fair supply of labour is available, but there is a shortage of skilled and casual hands in a few districts.

North Wales.—Labour is still deficient except in a few districts, and the shortage may be keenly felt when improved conditions allow farm work to make normal progress.

Mid Wales.—Generally the supply of labour appears to be about sufficient to meet requirements, though there is a scarcity of all classes in some districts.

South Wales.—Labour is scarce, and farmers view the whole question of farm labour with great apprehension. The scarcity will be seriously felt later when the weather settles.

STATEMENT showing the Average Price of **British Corn**, per Quarter (Imperial Measure), for the Quarter ending Lady Day, 1919, pursuant to the Corn Returns Act, 1882.

<i>Wheat.</i>	<i>Barley.</i>	<i>Oats.</i>
<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
72 6	62 4	48 7

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of March, 1917, 1918, and 1919.

	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919.	1917.	1918.	1919.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
London ...	81 2	73 7	72 11	66 1	56 2	62 6	52 3	52 7	51 3
Norwich ...	78 2	72 3	72 8	63 3	56 8	62 6	49 2	47 6	50 1
Peterborough	79 0	71 10	72 2	64 0	56 7	61 11	49 4	49 6	47 7
Lincoln ...	81 1	71 11	72 7	65 1	56 10	62 10	50 1	54 7	47 4
Doncaster ...	79 7	71 11	71 10	65 4	56 4	62 8	49 11	46 0	47 0
Salisbury ...	78 7	71 7	72 5	64 6	57 7	62 3	48 8	50 11	46 10

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1917, 1918 and 1919.

Weeks ended (in 1919).	WHEAT.					BARLEY.					OATS.				
	1917.	1918.	1919	1917.	1918.	1919.	1917.	1918.	1919.	1917.	1918.	1919.			
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.			
Jan. 4 ..	76 0	71 2	72 2	66 4	58 0	62 3	47 1	45 5	48 8						
" 11 ..	75 8	71 2	72 6	65 7	58 2	62 5	47 2	46 9	49 8						
" 18 ..	75 8	71 3	72 7	64 9	58 1	62 3	47 4	47 9	50 0						
" 25 ..	75 10	71 1	72 7	64 5	58 7	61 10	47 8	48 2	49 6						
Feb. 1 ...	75 10	71 2	72 8	64 0	58 10	62 4	47 3	50 2	49 7						
" 8 ...	76 0	72 0	72 7	63 5	59 0	62 3	46 11	50 6	49 2						
" 15 ...	76 3	72 3	72 8	63 8	58 11	62 5	47 3	52 0	49 0						
" 22 ...	76 9	72 2	72 8	63 9	58 9	62 6	47 8	52 3	49 4						
Mar. 1 ...	77 4	72 2	72 7	64 0	57 9	62 7	48 0	52 0	48 8						
" 8 ...	78 0	72 3	72 6	63 7	58 5	62 7	48 7	52 2	48 6						
" 15 ...	78 10	72 4	72 5	64 1	56 10	62 5	49 4	51 0	46 8						
" 22 ...	80 3	72 3	72 7	65 6	56 9	62 1	50 4	50 3	46 4						
" 29 ...	81 5	72 4	72 7	71 10	56 7	62 8	51 10	48 10	46 11						
Apl. 5 ...	84 4	72 11	72 6	69 11	56 7	62 8	55 1	49 10	47 2						
" 12 ...	85 2	73 3		71 10	56 6		57 2	47 2							
" 19 ...	84 10	73 3		70 6	56 6		59 8	47 0							
" 26 ...	81 1	73 3		69 5	56 10		58 6	46 8							
May 3 ...	77 7	73 5		64 4	56 5		54 9	47 4							
" 10 ...	78 0	73 5		64 11	56 6		55 2	47 6							
" 17 ...	77 11	73 4		64 10	56 6		55 2	46 4							
" 24 ...	78 0	73 3		64 9	56 6		54 11	47 8							
" 31 ...	78 0	73 8		65 11	60 0		54 11	44 9							
June 7 ...	78 0	73 11		67 7	59 2		55 0	45 5							
" 14 ...	78 2	74 3		75 6	57 9		55 1	45 7							
" 21 ...	78 1	74 4		75 0	58 5		55 2	47 8							
" 28 ...	78 3	74 4		73 11	57 10		55 1	46 4							
July 5 ...	78 1	74 4		69 5	61 7		55 2	46 10							
" 12 ...	78 2	74 4		70 10	57 5		55 1	47 0							
" 19 ...	78 3	74 3		72 1	60 5		55 2	45 4							
" 26 ...	78 3	74 3		65 7	56 11		55 2	46 2							
Aug. 2 ...	78 2	74 3		73 6	57 1		55 0	45 10							
" 9 ...	78 4	74 7		76 1	57 7		55 0	46 3							
" 16 ...	78 7	74 2		68 11	61 4		55 6	55 11							
" 23 ...	76 7	74 8		70 7	62 6		54 7	56 9							
" 30 ...	72 1	74 8		60 4	60 1		49 0	57 11							
Sept. 6 ...	71 6	72 3		59 3	60 4		46 7	56 9							
" 13 ...	70 7	72 5		57 2	60 1		45 0	49 2							
" 20 ...	70 8	72 6		56 10	60 4		45 8	49 11							
" 27 ...	70 6	72 7		58 5	60 3		44 7	50 3							
Oct. 4 ...	70 8	72 8		57 9	60 3		44 9	50 9							
" 11 ...	71 0	72 6		58 5	60 3		44 5	51 6							
" 18 ...	70 8	72 7		59 3	60 3		44 1	50 9							
" 25 ...	70 10	72 5		60 1	60 3		43 0	50 5							
Nov. 1 ...	70 4	72 4		59 11	60 3		42 4	50 8							
" 8 ...	70 3	72 4		60 2	60 3		42 11	49 11							
" 15 ...	70 3	72 5		60 2	60 3		43 0	49 10							
" 22 ...	70 2	72 4		59 9	60 10		43 1	51 1							
" 29 ...	70 2	72 3		59 3	62 2		44 6	50 4							
Dec. 6 ...	70 7	72 4		58 7	62 6		43 5	51 4							
" 13 ...	71 2	72 3		58 0	62 7		43 6	51 4							
" 20 ...	71 1	72 4		57 7	62 3		44 2	50 5							
" 27 ...	71 1	72 3		57 7	62 3		44 10	50 6							

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 56 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in March and February, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	MARCH.		FEBRUARY.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.
FAT STOCK :—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Cattle :—				
Polled Scots	81 8	76 3	80 8	75 0
Herefords	81 4	75 10	80 2	75 0
Shorthorns	80 9	75 8	79 10	74 10
Devons	80 9	75 5	80 2	75 2
Welsh Runts	—	—	79 0	76 0
Fat Cows	75 9	67 8	74 9	66 10
	First Quality.	Second Quality.	First Quality.	Second Quality.
	per lb.*	per lb.*	per lb.*	per lb.*
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
Veal Calves	12½	10½	12½	11
Sheep :—				
Downs	14½	14½	14½	14½
Longwools	14½	14½	14½	14½
Cheviots	14½	14½	14½	14½
Blackfaced	14½	14½	14½	14½
Welsh	14½	14½	14½	14½
Cross-breds	14½	14½	14½	14½
	per score. live weight.	per score. live weight.	per score. live weight.	per score. live weight.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Pigs :—				
Bacon Pigs	21 0	21 0	21 0	21 0
Porkers	21 0	21 0	21 0	21 0
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>
Shorthorns—In Milk ...	50 0	36 15	51 18	38 14
" —Calvers ...	44 1	33 10	45 16	34 11
Other Breeds—In Milk ...	44 2	32 0	45 6	37 4
" —Calvers ...	—	—	—	—
Calves for Rearing	3 9	2 12	3 9	2 12
Store Cattle :—				
Shorthorns—Yearlings ...	16 9	13 5	16 10	13 7
" —Two-year-olds...	26 2	21 16	25 17	21 17
" —Three-year-olds	35 0	30 14	33 18	28 18
Herefords—Two-year-olds...	27 0	22 0	26 17	22 12
Devons—	26 15	22 12	27 10	22 19
Welsh Runts—	27 0	22 2	27 0	22 0
Store Sheep :—				
Hoggs, Hoggets, Togs, and Lambs—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Downs or Longwools ...	72 8	59 10	68 10	55 4
Store Pigs :—				
8 to 12 weeks old	46 10	34 5	44 5	30 9
12 to 16 " "	83 7	62 5	79 10	59 4

* Estimated carcass weight.

NOTE.—The prices per lb. for sheep do not include the value of the skins or pelts, which during March made prices equivalent to an additional 2d. per lb. of the carcass weight for Downs and Cross-breds, 1½d. for Longwools, Cheviots and Blackfaced, and 1½d. for Welsh, and during February, 1½d. per lb. for Downs and Cheviots, 2d. for Longwools and Cross-breds, and 1½d. for Blackfaced and Welsh.

In addition to the price quoted above for sheep per lb., sellers were entitled, under the Live Stock (Sales) Order, 1918, to charge an extra amount ranging from 3s. to 10s. per head during March, and 2s. 6d. to 8s. 4d. during February, according to the weight of the sheep.

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at
certain MARKETS in ENGLAND in March, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	—	—	—	—	27 6	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	—	—	—	—	—	—
„ Factory	—	—	—	—	—	—
Imported (Controlled)	252 0	—	252 0	—	252 0	—
CHEESE :—						
British—						
Cheddar	158 6	—	—	—	158 6	—
					120 lb.	
Cheshire	—	—	—	—	170 0	—
					per cwt.	
Canadian	158 6	—	158 6	—	158 6	—
BACON :—						
Irish (Green)	189 6	—	189 6	—	189 6	—
Canadian (Green sides)	185 0	—	185 0	—	185 0	—
HAMS :—						
York (Dried or						
Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green)						
(long cut)	178 6	—	178 6	—	178 6	—
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	35 7	32 11
Irish	31 6	—	34 0	31 6	32 3	30 0
Danish	—	—	34 8	32 4	33 6	31 6
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Arran Chief	180 0	160 0	201 6	195 0	190 0	—
Edward VII.	215 0	192 6	203 6	191 6	200 0	—
Up-to-Date	210 0	180 0	163 6	—	—	—
HAY :—						
Clover	—	—	—	—	—	—
Meadow	—	—	—	—	—	—

AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in March, 1919.

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	London.	Man- chester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—						
English	1st	118 6	118 6	—	118 6	118 6
	2nd	118 6	118 6	—	118 6	118 6
Cow and Bull	1st	118 6	118 6	118 6	118 6	118 6
	2nd	118 6	118 6	99 6	104 0	100 6
Irish : Port Killed	1st	120 6	—	118 6	118 6	118 6
	2nd	—	—	118 6	118 6	118 6
Argentine Frozen—						
Hind Quarters	1st	134 0	134 0	134 0	134 0	134 0
Fore „	1st	103 6	103 6	103 6	103 6	103 6
American Frozen—						
Hind Quarters	1st	131 6	131 6	131 6	131 6	131 6
Fore „	1st	101 0	101 0	101 0	101 0	101 0
Canadian Frozen—						
Hind Quarters	1st	131 6	131 6	131 6	131 6	132 0
Fore „	1st	101 0	101 0	101 0	101 0	102 0
VEAL :—						
British	1st	99 6	99 6	99 6	99 6	99 6
	2nd	99 6	87 0	85 0	87 0	84 6
Foreign	1st	—	—	—	—	—
MUTTON :—						
Scotch	1st	125 6	125 6	125 6	125 6	125 6
	2nd	125 6	125 6	125 6	125 6	125 6
English	1st	125 6	125 6	—	125 6	125 6
	2nd	125 6	125 6	—	125 6	125 6
Irish : Port Killed	1st	—	—	125 6	—	125 6
	2nd	—	—	125 6	—	125 6
Argentine Frozen	1st	125 6	125 6	125 6	125 6	125 6
New Zealand „	1st	—	—	—	—	123 6
Australian „	1st	—	—	—	—	—
LAMB :—						
British	1st	—	—	—	—	—
	2nd	—	—	—	—	—
New Zealand	1st	123 6	—	123 6	125 6	123 6
Australian... ..	1st	—	—	—	—	—
Argentine... ..	1st	125 6	125 6	125 6	125 6	125 6
PORK :—						
British	1st	149 6	149 6	149 6	149 6	149 6
	2nd	149 6	—	—	149 6	—
Frozen	1st	—	—	—	—	—

DISEASES OF ANIMALS ACTS 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	MARCH.		THREE MONTHS ENDED MARCH.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	18	32	51	86
Animals attacked	23	37	70	100
Foot-and-Mouth Disease :—				
Outbreaks	3	—	19	—
Animals attacked	17	—	106	—
Glanders (including Farcy) :—				
Outbreaks	3	6	3	9
Animals attacked	16	26	16	30
Parasitic Mange :—				
Outbreaks	728	580	2,118	1,859
Animals attacked	1,399	1,124	4,313	3,592
Rabies :—				
Number of cases	11	—	30	—
„ „ Dogs affected	11	—	27	—
„ „ other animals affected	—	—	3	—
Sheep-scab :—				
Outbreaks	42	40	193	201
Swine Fever :—				
Outbreaks	120	82	275	195
Swine slaughtered as diseased or exposed to infection	45	41	95	76

IRELAND.*(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)*

DISEASE.	MARCH.		THREE MONTHS ENDED MARCH.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	—	1	—	1
Animals attacked	—	1	—	1
Glanders (including Farcy) :—				
Outbreaks	1	—	1	—
Animals attacked	1	—	1	—
Parasitic Mange :—				
Outbreaks	19	10	44	45
Sheep-scab :—				
Outbreaks	26	29	114	135
Swine Fever :—				
Outbreaks	5	4	14	6
Swine slaughtered as diseased or exposed to infection	9	12	47	26

The Weather in England during March.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.	
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours
<i>Week ending 8th Mar.:</i>								
England, N.E. ...	38·6	—1·0	0·62	16	+ 4	4	2·5	—0·8
England, E. ...	42·0	+1·9	1·06	27	+16	6	1·5	—1·8
Midland Counties ...	40·4	+0·5	1·03	26	+14	6	2·0	—1·0
England, S.E. ...	44·4	+3·2	1·97	50	+ 3	7	1·8	—1·6
England, N.W. ...	39·0	—1·2	1·28	33	+16	5	2·3	—0·6
England, S.W. ...	43·7	+2·1	1·98	50	+29	7	2·7	—0·7
English Channel ...	47·4	+3·2	1·86	47	+28	6	3·6	—0·2
<i>Week ending 15th Mar.:</i>								
England, N.E. ...	40·1	—0·7	1·11	28	+19	6	0·8	—3·2
England, E. ...	42·0	+0·9	0·42	11	+ 3	5	1·8	—2·0
Midland Counties ...	40·6	—0·7	1·39	35	+26	4	2·1	—1·4
England, S.E. ...	43·1	+0·9	0·37	9	— 1	5	2·5	—1·3
England, N.W. ...	40·2	—1·2	1·54	39	+26	4	2·2	—1·2
England, S.W. ...	41·9	—0·7	1·23	31	+17	5	3·3	+0·3
English Channel ...	45·8	+0·5	0·88	22	+11	6	4·3	—0·6
<i>Week ending 22nd Mar.:</i>								
England, N.E. ...	37·0	—4·1	0·70	18	+ 8	4	2·5	—1·9
England, E. ...	37·2	—4·3	0·47	12	0	5	2·0	—2·3
Midland Counties ...	36·6	—4·6	1·58	40	+29	4	2·1	—1·7
England, S.E. ...	38·1	—4·3	1·04	26	+14	5	1·4	—3·0
England, N.W. ...	36·8	—4·8	1·21	31	+18	4	2·3	—1·7
England, S.W. ...	39·2	—3·6	1·28	33	+16	4	3·3	—1·1
English Channel ...	42·9	—2·5	0·98	25	+10	5	3·4	—1·5
<i>Week ending 29th Mar.:</i>								
England, N.E. ...	35·4	—6·6	0·17	4	— 6	3	5·2	+0·8
England, E. ...	35·6	—7·3	0·27	7	— 1	2	5·4	+0·7
Midland Counties ...	35·2	—7·5	0·28	7	— 3	3	5·6	+1·4
England, S.E. ...	37·5	—6·4	0·48	12	+ 3	3	5·1	+0·3
England, N.W. ...	35·4	—7·2	0·43	11	— 4	2	5·5	+1·0
England, S.W. ...	36·8	—7·2	0·60	15	0	4	5·7	+0·8
English Channel ...	41·7	—5·2	1·22	31	+19	6	3·0	—2·8

* 1 inch = 25·4 millimetres.

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EDITORIAL NOTES.

It is desirable to impress upon the public that rabies or hydrophobia is a disease of a very serious and dangerous nature, not only to dogs, but to human beings affected by it. All the drastic steps which are being taken to stamp out the disease are almost certain to be rendered nugatory if dogs are smuggled from abroad or are surreptitiously moved from one district to another contrary to the precautionary regulations in force. Further, heavy responsibility rests upon all who knowingly and wilfully disobey the Orders which have been made for the general welfare of the community, inasmuch as their action affects others.

The great risk of the spread of this terrible disease through failure to notify suspicious cases, whether in ignorance or otherwise, should cause anyone having knowledge of any case in which the behaviour of a dog is abnormal to inform the police without an hour's delay. Such action may make all the difference between stamping out the disease and distributing it, between health and disease, and between life and death to human beings.

* * * * *

THE statement that there was an estimated increase of about a quarter of a million pigs on farms in England and Wales on 1st April compared with the same date

Pig Keeping. last year is gratifying so far as it shows an increase rather than a decrease, but inasmuch as pigs normally vary somewhat widely in numbers at different dates, and as there had been a very heavy falling-off since the outbreak of War (over three-quarters of a million, or

31 per cent., in England and Wales in the four years ending June last), we have much leeway to make up before the pre-war position is reached. Farmers, however, need scarcely more than a reminder that even the pre-war basis is unsatisfactory, for this country should be in a position to rear many more pigs than it ever has done. The rearing of more pigs will be a great benefit to farmers, as not only are pork and bacon required for the home market, but a keen demand for breeding pigs for export may certainly be expected. Pigs also afford an economic outlet for feeding stuffs, which may now be much more freely obtained. Finally, the consuming public, while fully grateful for supplies from almost any source during the War, recognises that most of the imported bacon and hams have been inferior to home-cured, and is accordingly prepared to take the latter in increased quantities. The pig is prolific, is easily fed and reared, yields a quick and not unprofitable return, and makes more economic use of its food in the production of meat than any other class of farm livestock. To attain the best results, from the point of view of vigour, quality and economy, especially breeding pigs, pigs should be kept more largely on open-air principles, for the pig is a grazer and can make use of fairly considerable quantities of green fodder in conjunction with concentrated foods.

* * * * *

THE Society of Motor Manufacturers and Traders have arranged for trials of agricultural tractors and self-contained motor ploughs of all kinds to be held at Lincoln in September. Entries are invited for both internal combustion and steam-driven machines. The trials will not be confined to ploughing and cultivating, but will include also hauling and threshing. The tractors (and self-contained motor-ploughs) and the hauled implements will be reported upon separately. Regard will be had to the total weight of the machines, the pressure per square foot, cost in proportion to draw-bar, ease of handling, mechanical construction and reliability; implements will be judged upon their construction, adaptability and the quality of work done. The judges have been appointed by the National Farmers' Union.

These trials are the first extensive tests to be carried out in this country after the close of the War. In October, 1917, noteworthy trials were conducted in Scotland, but the restriction of British enterprise which had been caused by war conditions was reflected in the comparatively few entries by

British firms. It is known that many British firms have made great endeavours since the conclusion of the Armistice to produce tractors which will compete in design, reliability and price with imported machines, and the Lincoln trials should be of especial interest from this point of view.

The Board of Agriculture, through the instrumentality of the Food Production Department, have done a great deal of work in importing and working a large number of machines of varied types, and it is not too much to say that in two years they have been responsible for experimental work which normally would have been spread over a decade. The tractor has now been familiarised to the farmer, and the mistrust or even hostility with which it was regarded at the beginning of 1917 has changed completely to an appreciation of its essential place in agriculture. The lessons, too, which have been taught by tractors under conditions existing in the British Isles have not been lost on manufacturers, whether in America or in this country, and there should be a great deal of evidence in the forthcoming trials of experience gained during the last two years.

* * * * *

THE War has witnessed a considerable development in the home production of food in this country, and not the least gratifying feature has been the fine achievement

Allotments. of allotment holders who have largely contributed in the national emergency to the food supplies of the country. The annual production of an estimated quantity of not less than 500,000 tons of valuable food by allotment holders throughout England and Wales is a result in which the growers may take a justifiable pride. The hope may be expressed that in the present season the British people, individually and collectively, will ensure that the stimulus thus given to gardening shall continue, and not die out with the cessation of hostilities. If the good result stated can be obtained under stress of war-time conditions of work, even more might be accomplished under conditions of peace. There is a tendency at present for shorter hours in industry. Shorter hours, however, should not imply idleness outside working hours, but rather more time in which to pursue other interests, and the growing of garden produce is not only productive but attractive and profitable, while it offers healthy spare-time employment which is highly beneficial to those who follow a sedentary occupation or "business" life.

THE INFLUENCE OF FARMYARD MANURE ON THE CLOVER CROP.

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AN enormous amount of experimental work has been carried out during the last 35 years in connection with the manuring of farm crops, so much indeed that it might be thought there could be no possible scope for more. In the main the work has been concerned with the effects of artificial fertilisers on single crops, especially on cereals, roots and grass.

Few experiments have been made on the clover crop, in spite of its great importance in the rotation. This is probably the result of its liability to "sickness," which rules out all possibility of continuous experiments, such as those at Rothamsted, Woburn and elsewhere, on cereals and roots. A certain number of experiments have been on grass mixtures containing clover, but these have been mostly in the north and west of England, where such leys are down for a longer period and, therefore, assume more obvious importance than in the southern and eastern counties, where the ley usually consists of pure clover and is down for one year only.

It is well recognised now, however, that clover plays a unique part in the rotation by providing stores of nitrogen not only for itself, but also for succeeding crops. Obviously, any treatment that increases the clover crop may be expected to react on the following cereal crop, and any improvement that may result would thus exert a twofold effect, giving not only more clover, but rendering possible a larger cereal crop.

One of the fields at Rothamsted was laid out in 1904 to test the residual value of a number of manures, including farmyard manure, shoddy, guano, rape cake, superphosphate, bone meal and basic slag. No regular rotation was adopted, but clover was avoided. This rather unusual course was followed because it was desired to avoid the complication that a clover crop would certainly have introduced. After the experiment had gone on for twelve years it was decided to make a change and to introduce clover: the twelfth crop had been mangolds. A crop of wheat was, therefore, taken as the thirteenth crop in 1915-16; this was seeded with clover, to which no manure was given.

The field is divided into eight strips, each of which receives a particular manure. The manure is not applied each year over the whole strip, however, but only over part. The strip is divided into five plots, one of which is unmanured, while each of the other four receives a dressing of manure in turn, so that four years elapse before any particular plot receives a second dressing.

TABLE I.—Yield of Clover on Little Hoos Field, 1917.

Plot No.	Manure.	Date of Application.	Yield of Clover per Acre.		
			1st Crop	2nd Crop	Total.
			cwt.	cwt.	cwt.
A 1	Dung (ordinary), 16 tons per acre.	Control*	19.7	22.2	41.9
2		Nov. 1915	38.2	27.4	65.6
3		1913	31.7	27.7	59.4
4		1914	26.2	26.6	52.8
5		April, 1915	31.9	26.1	58.0
B 1	Dung (cake-fed) 16 tons per acre.	Nov. 1915	38.4	27.2	65.6
2		Control	19.1	21.7	40.8
3		1913	34.3	26.9	61.2
4		1914	35.8	26.1	61.9
5		April, 1915	32.7	26.9	59.6
C 1	Shoddy 950 lb. per acre.	Nov. 1915	17.6	24.0	41.6
2		1913	18.6	21.7	40.3
3		Control	20.7	24.6	45.3
4		1914	19.7	25.1	44.8
5		April, 1915	17.6	26.6	44.2
D 1	Guano, 770 lb. per acre.	Nov. 1915	19.4	27.4	46.8
2		1913	18.6	24.0	42.6
3		1914	21.7	25.6	47.3
4		Control	20.4	27.2	47.6
5		April, 1915	19.7	29.0	48.7
E 1	Rape Cake, 1,030 lb. per acre.	Nov. 1915	18.6	25.6	44.2
2		1913	18.9	26.1	45.0
3		1914	19.7	24.3	44.0
4		April, 1915	20.2	28.2	48.4
5		Control	24.1	28.5	52.6
F 1	Superphosphate, 600 lb. per acre.	Control	14.2	26.9	41.1
2		Nov., 1915	18.1	23.8	41.9
3		1913	16.5	25.0	42.4
4		1914	19.9	29.3	49.2
5		April, 1915	23.0	30.8	53.8
G 1	Bone Meal, 430 lb. per acre.	Nov., 1915	14.7	29.0	43.7
2		1913	15.2	29.3	44.5
3		Control	14.7	29.0	43.7
4		1914	17.8	29.5	47.3
5		April, 1915	18.9	29.3	48.2
H 1	Basic Slag, 600 lb. per acre.	Nov., 1915	24.3	24.6	48.9
2		1913	21.7	23.8	45.5
3		1914	23.3	22.5	45.8
4		April, 1915	21.0	22.8	43.8
5		Control	18.0	23.6	41.6

* In all cases the control plots had been without manure since 1904.

In consequence, some of the clover plots had received manure for the preceding wheat crop, others for the mangold crop grown two years before, others for the barley preceding the mangolds, others for the swedes preceding the barley, while others again, described as controls, had had no manure since 1904.

The whole field received 3 cwt. of sulphate of potash in 1906, and 2 cwt. in 1911.

The results are given in detail in Table I. They bring out the very interesting fact that none of the manures except farmyard manure has any marked effect in increasing the clover crop. Rape cake, guano and shoddy seem to have no effect at all, even when applied to the preceding wheat crop. Superphosphate, bone meal and basic slag may have had a small effect, but nothing very definite. Farmyard manure, on the other hand, has had a striking effect; the clover grown after manured wheat gave crops as follows:—

<i>Manure Applied to preceding Wheat Crop.</i>	<i>Yield of Clover. Cwt. per Acre.</i>		
	<i>1st Cut.</i>	<i>2nd Cut.</i>	<i>Total.</i>
No manure (mean of eight plots) ..	18.9	25.4	44.3
Farmyard manure (ordinary) ..	38.2	27.4	65.6
„ „ (cake-fed) ..	38.4	27.2	65.6
Shoddy	17.6	24.0	41.6
Guano	19.4	27.4	46.8
Rape cake	18.6	25.6	44.2
Superphosphate	18.1	23.8	41.9
Bone meal	14.7	29.0	43.7
Basic slag	24.3	24.6	48.9

There is, however, a further striking result. The effect of farmyard manure is not exhausted after a single season: dressings applied two, three, or even four years beforehand produced the following notable increases in crop:—

<i>Farmyard Manure } Applied in 1915. }</i>	<i>Clover Crop of 1917. Cwt. per Acre.</i>				
	<i>1915. (Nov. 24)</i>	<i>1915. (Apr. 2)</i>	<i>1914.</i>	<i>1913.</i>	<i>None applied.</i>
Ordinary dung	65.6	58.0	52.8	59.4	41.9
Cake-fed dung	65.6	59.6	61.9	61.2	40.8

The broad result of the experiment is that farmyard manure has caused increases in the clover crop, no matter when it was applied in the rotation, while the other fertilisers have not. This is shown in the summary of all the plots given on the next page.

All the results are higher than usual at Rothamsted, doubtless one consequence of the long period, exceeding fourteen years, that had intervened since the preceding clover crop. This is

no more than might have been expected, but it would hardly have been anticipated that farmyard manure would prove to be the only fertiliser that had left any residue of benefit to the clover.

<i>Manure Applied during the Four Preceding Years.</i>				<i>Yield of Clover, 1917.</i>		
				<i>1st Cut.</i>	<i>2nd Cut.</i>	<i>Total.</i>
				<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>
				<i>per Acre.</i>	<i>per Acre.</i>	<i>per Acre.</i>
No manure	..	..	..	18·9	25·4	44·3
Farmyard manure (ordinary)	..	..	..	32·0	27·0	59·0
" " (cake-fed)	..	..	..	35·3	26·8	62·1
Shoddy	..	..	..	18·4	24·3	42·7
Guano	..	..	..	19·9	26·5	46·4
Rape cake	..	..	..	19·4	26·0	45·4
Artificials	..	..	..	19·5	26·7	46·2

That of course is a very important practical consideration. Not only was the extra ton of clover valuable, but there was a distinct effect on the following wheat crop grown in 1918.

<i>Manure Applied to Mangolds, 1915.</i>				<i>Yield of Wheat, 1918, following Clover of 1917.</i>			
				<i>Clover, 1917.</i>	<i>Dressed Grain.</i>	<i>Straw.</i>	<i>Total Produce.</i>
				<i>Cwt.</i>	<i>Bush.</i>	<i>Cwt.</i>	<i>Lb.</i>
				<i>per Acre.</i>	<i>per Acre.</i>	<i>per Acre.</i>	<i>per Acre.</i>
No manure	..	..	..	44·3	36·8	37·3	6,775
Farmyard manure (ordinary)	..	..	..	59·0	43·0	43·3	7,888
" " (cake-fed)	..	..	..	62·1	45·1	45·3	8,209
Shoddy	..	..	..	42·7	34·7	34·8	6,392
Guano	..	..	..	46·4	36·5	36·9	6,751
Rape cake	..	..	..	45·4	36·0	37·7	6,774
Artificials	..	..	..	46·2	37·1	36·8	6,732

The higher clover crop was followed by a higher wheat crop and there was a gain of no less than 8 bush. of wheat and $7\frac{1}{2}$ cwt. of straw in the plots which had carried a good clover crop as compared with those which had not.

Several considerations may be adduced to account for the effect of the farmyard manure. One circumstance may to some extent have influenced the result. The preceding wheat crop had not been uniform over the whole field. Owing to the sudden incidence of wet weather at the end of November, 1915, it was impossible to complete the sowing of the wheat over the whole field; only the dunged strips were drilled, and the remainder of the field had to be left till February, 1916. In consequence there was a considerable difference in yield over the two parts, the dunged strips yielding much more heavily than the rest. Had the weather been very cold during the early days of the clover plants it is possible that the extra shelter would have helped them. In point of fact, however,

this was hardly the case; the clover was sown at the end of April after the cold weather had broken and the warm weather had set in.

The usual experience on the Rothamsted farm is that a dense wheat crop rather injures the clover, whilst a small wheat crop allows a fuller development. This is shown by the results from the five plots in the rape cake series:—

	E 1.	E 2 & 3.	E 4.	E 5.
Wheat crop—Total produce, lb. } per acre }	2,986	{ 2,768 2,749 }	2,466	2,084
Clover crop—Total produce, cwt. } per acre }	44.2	{ 45.0 44.0 }	48.4	52.6

In most plots in this particular field, however, there was no marked relationship: thus for the guano plots the figures are:—

	D 1.	D 4.	D 2.	D 3.	D 5.
Wheat crop—Total produce, lb. per acre	3,801	2,734	2,605	2,452	2,348
Clover crop—Total produce, cwt. per acre	46.8	47.6	42.6	47.3	48.7

Whatever the action, it only affected the first cut, as the aftermath was much the same on the farmyard manure plots as on the others. The results are:—

<i>Manure Applied.</i>	<i>1st Cut.</i>		<i>2nd Cut.</i>	
	<i>Cwt. per Acre.</i>		<i>Cwt. per Acre.</i>	
No manure	18.9	....	25.4	
Farmyard manure	33.7	....	26.9	
Other manures	19.3	....	25.9	

Part of the effect may be due to the potash contained in the farmyard manure. There are, however, two reasons against attributing everything to this cause. The Rothamsted soil is fairly well supplied with potash, and in addition the whole field had received 5 cwt. sulphate of potash per acre during the preceding twelve years. Further, in the case of the plots supplied with cake-fed dung there is little difference in yield, whether one, two, three or four crops have intervened since the date of application. There is more sign of falling off in yield of the clover crop where ordinary dung is used, but not nearly as much as happened with other crops: if the unmanured plot in all cases is put at 100 the dunged plots yielded as follows:—

	<i>1st</i> <i>Year.</i>	<i>2nd</i> <i>Year.</i>	<i>3rd</i> <i>Year.</i>	<i>4th</i> <i>Year.</i>	<i>5th</i> <i>Year.</i>
Clover, cake-fed dung .. —	—	158	144	150	147
Other crops, cake-fed dung	173	138	120	113	—
Clover, ordinary dung .. —	—	158	140	128	144
Other crops, ordinary dung	144	135	126	117	—

No record has been found of any similar experiment in this country, and it is, therefore, impossible to say how far the result is likely to be general. The nearest approach seems to be an old experiment made by the Essex Education Committee in 1904,* in which, however, farmyard manure gave practically no increase in crop; the only effective fertiliser when applied alone was basic slag. The figures are:—

Clover in Rotation:—Beans, Wheat, Barley, Clover, Hay.

<i>Manure per Acre.</i>	<i>Yield of Clover. Cwt. per Acre.</i>
No manure	38.0
Dung, 12 tons	39.7
Superphosphate, 4 cwt.	43.4
Sulphate of ammonia, 1 cwt.	
Kainit, 1 cwt.	
Basic slag, 4 cwt.	44.2
Dung, 12 tons	45.7
Superphosphate, 3 cwt.	

An experiment more closely resembling that at Rothamsted was made in Virginia in 1902 and 1909,† and the results were similar. Various fertilisers were applied to the wheat crop in 1901; their effect on the succeeding clover crop was very marked:—

<i>Manure Applied to Wheat Crop in 1901.</i>	<i>Clover Hay (2 Crops). Lb. per Acre.</i>	<i>Repetition in 1909. Mixture of Timothy and Clover Hay. Lb. per Acre.</i>
No manure	2,850	505
Stable manure, 2 tons	9,550	7,800
Sodium nitrate, 40 lb.	7,250	4,700
Acid phosphate, 40 lb.		
Potassium sulphate, 15 lb.		
Sodium nitrate, 40 lb.	2,000	2,125
Potassium sulphate, 15 lb.		
Sodium nitrate, 40 lb.		
Acid phosphate, 40 lb.	6,700	5,600
Potassium sulphate, 15 lb.		
Lime (100 lb. in 1900)		

Again, at the Ohio Experimental Station‡ it was found that the clover responded better to farmyard manure than to any other fertiliser in a five-year rotation, as will be seen from the table on the next page.

* See this *Journal*, 1904, Vol. XI., p. 104.

† "Plot Experiments with Fertilisers," W. Virginia Station, Bulletin 131, November, 1910.

‡ "Experiments with Fertilisers, Manure, Lime, and Floats," Ohio Expt. Station, Bulletin 260, 1913, p. 431.

Clover in Five-year Rotations:—Maize, Oats, Wheat, Clover, Timothy.

Manure.	Average Yield (6 Crops). Lb. per Acre.					
No manure, lime	2,383
" " floats*	3,650
Farmyard manure, lime	3,945
" " floats	4,653
Complete fertiliser, lime	3,504
" " (low nitrogen), floats	3,974
Complete fertiliser, lime	3,630
" " (high nitrogen), floats	4,217

Against these results, which are in accordance with those obtained at Rothamsted, must be set one at Iowa,† where in a rotation of maize, maize, oats, clover, the farmyard manure proved no more effective than phosphates and potassium salts. Here, however, the manure was applied on the clover sod just before ploughing, so that only a fifth-year residue was available :—

Clover in Four-year Rotations:—Maize, Maize, Oats, Clover.

Manure.	Average Yields for Eight-year Period, 1906-1913. Tons per Acre.					
No manure	2.25
Farmyard manure	2.82
Farmyard manure, cowpeas, phosphorus	3.11
Cowpeas, phosphorus, potassium	3.35
Farmyard manure, phosphorus, potassium	3.06
Phosphorus, potassium	2.90

The manures applied and the rates per acre were as follows :—

Farmyard Manure.—Eight tons per acre applied once in every four-year period to the clover sod, just before ploughing.

Phosphorus.—Steamed bone meal, 800 lb. per acre—applied to the clover sod before ploughing.

Potassium.—Muriate of potash or potassium sulphate, 400 lb. per acre—applied to the clover sod before ploughing.

Cowpeas.—Sown in the corn at the last cultivation—about 1 bush. per acre.

It is evident from the various data shown in this article that farmyard manure may have an important residual effect on clover which should be taken into account in estimating its effects on the rotation.

* The name "Floats" is given to finely-ground rock phosphate.

† "Maintaining Fertility in the Wisconsin Drift Soil Area of Iowa." Iowa Station, Bulletin 161, October, 1915.

THE POSSIBILITIES OF THE BRITISH FRIESIAN COW FOR DAIRY PURPOSES.

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It would be difficult to say when the cattle from the Netherlands first came to Britain. A certain amount of evidence exists in support of the suggestion that cattle from the lowlands of Europe were imported into Britain during the Roman occupation of this country. Wilson in the "Evolution of British Cattle" states that "there was no general migration of cattle to Britain from Anglo-Saxon times until the Dutch importations of the seventeenth and eighteenth centuries." In "Systema Agriculturae," by J. Worlidge, published in 1681 the following reference to Dutch cattle occurs: "The best sort is the large Dutch cow that brings two calves at one birth, and gives ordinarily 2 gal. of milk in one meal." In this connection it is interesting to note that the British Friesian cows to-day are probably more liable than the representatives of other breeds to produce twin calves. Worlidge's opinion is confirmed by Mortimer in his book "The Whole Art of Husbandry," wherein he states that "the best sort of cows for the pail . . . are the long-legged short-horned cow of the Dutch breed, which is to be had in some places of Lincolnshire, but mostly in Kent; many of these cows will give 2 gal. of milk at a meal." Several of the early shorthorn breeders in Durham and the North Riding of Yorkshire imported Dutch bulls, and it is known that Dutch cattle were helpful in developing several modern breeds.

In their native home Friesian cattle have been known as such for about 2,000 years, although it is scarcely possible that there are no unbroken links in such a long chain. The Dutch cattle imported into this country in the seventeenth and eighteenth centuries were red and white, and possibly they were more of the modern Meuse-Rhine-Yssel than of the present day Friesian type. An examination of the pictures of Paul Potter, Rubens, Berghem, Cuyp, Teniers, Vandervelde, and others leads to the belief that the black and white colour was almost unknown in Holland three centuries ago. To-day the black and white Friesian largely predominates, the few red and white herds being preserved mainly by in-breeding. The

two varieties are kept entirely separate for herd-book registration purposes, and it is only the black and white animals that are exported or recognised by the many Friesland cattle breeding associations outside of Holland.

In the Netherlands at the present time there are several varieties of cattle, namely, the Friesians, and the North and South Holland types, the distinction being that Friesians are registered in a select Friesian Herd Book, whilst the "Holland groups" are controlled by the Netherland Herd Book Association, which includes the black white-headed Groninger, and the red and white Meuse-Rhine-Yssel. It is the Friesland type that British breeders have adopted, and steps are being taken to eliminate the few animals showing the Groningen type.

The Friesian cattle have for centuries been bred mainly for milk production, and the province from which they take their name has long been known as the greatest dairying district in the world. The extent to which Friesland is devoted to dairying may be gathered from the fact that the exportation of butter from Friesland to England alone in 1874 averaged over 200 lb. per cow, a creditable performance, even had there been no home consumption and no further exportations. During the seventeenth and eighteenth, and particularly in the nineteenth centuries, importations of cattle from Holland were frequent. In the decade 1872-1882 the annual importation varied from 34,000 to 86,000 head of cattle. Until 1892, when the importation of cattle was prohibited, black and white cattle were very numerous in this country, particularly in the Metropolis and in the districts surrounding large towns in the south-east and east of England and Scotland.

From 1892 until the formation of the British Friesian Cattle Society, in 1909, several herds were maintained in a pure state in this country, but in only a few cases did owners endeavour to improve their stock or even to retain the uniform character of the Friesland type. Five experienced breeders gave their services to the work of building up the herd book, and in 1912 the first volumes were issued. In 1914, by permission of the Government, an importation of new blood, 39 bulls and 20 heifers, was obtained from Holland. Some idea of the great strides made by the breed since the first volume was issued, in 1912, may be gathered from the following figures* :—

* The above particulars concerning the history of the breed have been obtained from an article by George Hobson, on "British Friesian Cows," published in the *Transactions of the Highland and Agricultural Society of Scotland*, 1918, Vol. XXX.



FIG. 1.—Eske Hetty



FIG. 2.—Routh Hetty (as a heifer).

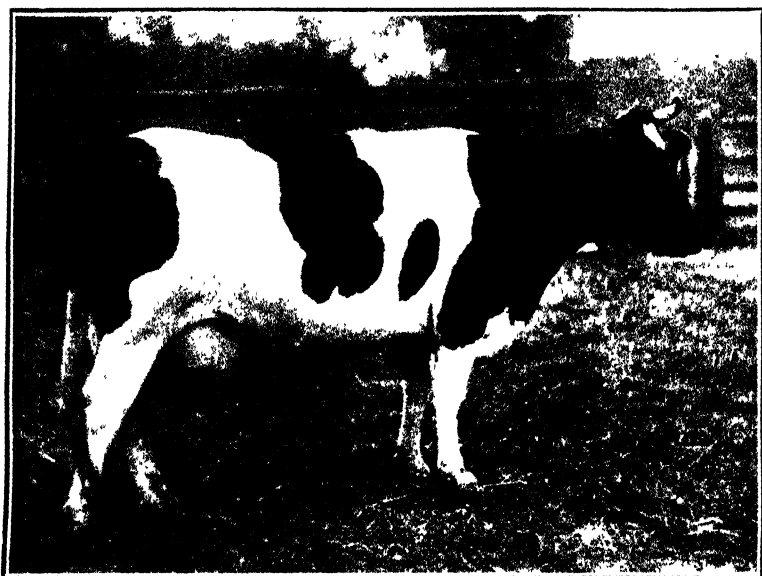


FIG. 3.—Hedges Moss Rose.



FIG. 4.—Routh Blossom (as a heifer).

	1911.	1918.
Number of breeders	50	700
Number of registered stock	2,000	17,000
Average size of herds	40	26
Estimated number of milking cows ..	1,000	10,000
Estimated annual yield of milk, gallons	800,000	8,000,000
Estimated value of stock	£40,000	£1,700,000

In 1914, the writer received a request from Mr. F. B. May, of Saltcote Hall, Heybridge, for advice and assistance in his endeavour to produce a heavy milking herd of Friesian cows giving good quality milk.

Mr. May's herd was a small one consisting of 12 cows, 5 young heifers, and one of the best home-bred bulls then existing. Several of the cows had a fairly long pedigree of pure Friesian blood; others had no pedigree at all, and in a few cases it was evident from their appearance that some of their ancestors were of doubtful Friesian breeding. No one who saw the herd in 1914 would have called it a "selected herd," or have praised it as of uniform character. Only 2 cows (Hedges Moss Rose and Hedges Trixie) cost more than 40 guineas, and the average cost per cow was only £34.

The disadvantages that are urged against the Friesian cow are: (1) The milk is of poor quality, although the quantity is admittedly large; (2) the constitution of the animal is not sufficient to stand the strain of several successive heavy lactation periods—in other words the cow milks to death; and (3) when the milking period is over the cow does not fatten well for beef.

At the commencement of the work the assumption was made that quality of milk and constitution were largely a matter of breeding. It was obviously impossible to obtain a herd of heavy milking cows, breeding regularly, unless the cows possessed first-class constitutions. It was therefore decided that all the young stock should be reared in the open air and out-wintered in the meadows, and this plan has been followed throughout with unqualified success. The cows themselves remain out all night from April till October, and every day throughout the winter they are turned out on the meadows for a few hours. Rightly or wrongly, the conclusion was come to that in-breeding was objectionable as liable to enfeeble the constitution, and under all circumstances the mating of related animals has been carefully avoided. It was deemed advisable not to allow the heifers to calve until three years old, in order that they might be fully developed before entering the milking herd. With one or two exceptions this last precaution has

been strictly adhered to, and although it is obviously too early to pronounce on the merits of the 2- to 2½-year-old as compared with the 3-year-old milking heifer, yet there are indications that the later calving gives the better results.

Samples of milk have been taken every fortnight from the morning's and evening's milk of each cow and analysed by the writer. As a rule, the samples were taken once every six weeks by the Recorder of the South-East Essex Milk Record Society, in which Society all the cows are registered for milk recording purposes, once a month by the writer, and by the owner or his deputy on the remaining occasions. The average percentage of fat and solids-not-fat for each cow for each lactation period has been obtained by calculating the number of pounds of fat and solids-not-fat produced during the period and determining what percentage that amount represented of the total yield of milk. The milk records are the result of daily weighings, and have been checked regularly by the Recorder of the South-East Essex Milk Record Society, the Recorder of the British Friesian Cattle Society, and by the writer. As circumstances permitted, the least successful cows have been weeded out, fattened and sold on the open market. When coming to a decision of this kind the factors which were taken into consideration were the quantity and quality of the milk produced,

TABLE I.—1915³ *Lactation Period.*

Name of Cow.	Age.	Quantity of Milk.	Average Fat.	Average Solids-not-Fat.	Period in Milk.
	years.	gal.	per cent.	per cent.	days.
Leerock Affection ..	8	1,080	3·86	9·08	253
Gilston Beattie ..	5	1,025	3·96	9·21	269
Lavenham Constance ..	7	1,039	3·74	8·93	282
Hedges Trixie ..	5	1,132	3·47	8·55	287
Hedges Moss Rose ..	6	1,219	3·29	8·26	289
Eske Hetty ..	5	1,501	3·50	8·80	311
Lavenham Kate ..	3	853	3·59	8·88	280
Gilston Bertha ..	6	881	3·41	8·50	237
Saltcote May II.* ..	3	539	3·71	8·71	224
Zuider, Daisy ..	10	968	4·04	8·76	323
Danesbury ..	7	1,151	3·86	9·00	359
Saltcote May I. ..	7	1,313	3·62	8·58	417
Saltcote Belle* ..	3	866	3·65	9·00	328
Average for 13 cows	5·8	1,044	3·67	8·79	297

* Heifer.

and the constitution and regular breeding powers of the cow. The results for three completed lactation periods are given in Tables I., II., and III.

At the end of the 1915 lactation period Zuider Daisy and Danesbury were fattened and sold to the butcher. They were both old cows, and Danesbury was difficult to get in calf, whilst Daisy was constitutionally unsound.

TABLE II.—1916 Lactation Period.

Name of Cow.	Age.	Quantity of Milk.	Average Fat.	Average Solids-not-Fat.	Period in Milk.
	years.	gal.	per cent.	per cent.	days.
Leerock Affection ..	9	1,165	4.18	9.05	258
Gilston Beattie ..	6	1,153	4.25	9.01	310
Lavenham Constance ..	8	1,515	3.88	8.60	338
Hedges Trixie ..	6	1,372	3.37	8.27	322
Hedges Moss Rose ..	7	1,308	3.46	8.45	266
Eske Hetty ..	6	1,496	3.27	8.90	254
Lavenham Kate ..	4	1,042	3.62	8.86	277
Gilston Bertha ..	7	895	3.73	8.47	251
Saltcote May II. ..	4	387	3.70	8.65	237
Saltcote Belle ..	4	1,069	3.74	9.07	270
Saltcote May I. ..	8	1,127	3.47	8.47	353
Eske Beauty ..	9	1,112	3.30	8.79	242
Eske Marigold ..	6	821	3.35	8.56	242
Average for 13 cows ..	6.5	1,112	3.64	8.70	278

Shortly after the end of the 1916 lactation period, May II. was fattened off and sold to the butcher as not likely to make a good milking cow. May I. was similarly disposed of, as she had proved to be an irregular breeder; the whole of this particular strain was thus eliminated. Bertha was also fattened and sold to the butcher on account of her comparatively low yield,

TABLE III.—1917 Lactation Period.

Name of Cow.	Age.	Quantity of Milk.	Average Fat.	Average Solids-not-Fat.	Period in Milk.
	years.	gal.	per cent.	per cent.	days.
Leerock Affection ..	10	1,338	3.89	8.93	270
Hedges Trixie ..	7	1,785	3.27	8.44	378
Hedges Moss Rose ..	8	1,642	3.54	8.38	279
Eske Hetty ..	7	2,575	3.36	8.92	410
Lavenham Kate ..	5	1,290	3.77	9.02	349
Eske Beauty ..	10	1,550	3.55	8.87	303
Routh Blossom ..	3	1,342	3.24	8.69	308
Saltcote Betty* ..	3	757	3.50	8.53	287
„ Nancy* ..	3	629	3.76	9.09	264
„ Norah* ..	3	1,043	4.02	9.20	369
Eske Poppy* ..	3	877	3.98	8.86	322
Routh Hetty* ..	3	1,176	3.74	8.97	298
Average for 12 cows	5.4	1,334	3.63	8.82	320

* Heifer.

and none of her stock was retained in the herd. Beattie and Constance had an acute attack of fever shortly after calving ; they never came down to milk, and were therefore fattened off. Belle, a very promising and vigorous young heifer, died owing to an accident a month before she was due to calve.

A considerable weeding out took place at the end of the 1916 lactation period. The cows weeded out were replaced by five heifers reared under conditions to be described later, and by a purchased heifer with a long milking pedigree. Notwithstanding the large introduction of young cows, the average yield per cow increased by over 200 gal., due to the phenomenal yields of the older cows, particularly Eske Hetty.

All the cows eliminated from the herd during the three years were, judging from appearances, those of doubtful Friesian pedigree, so that, by the end of 1917, an astonishing transformation in the appearance of the herd had taken place. Of the old cows which went through the 1917 lactation period, only one, Leeroock Affection, showed any signs of a doubtful pedigree—her calves have all been bull calves and were not registered.

Bearing in mind that many of the cows which formed the foundation stock of the herd were fairly old, there is as yet no evidence which would suggest that the constitution of the Friesian cow is in any way inferior to that of any other breed. Not a single cow has ever looked as if she was "milking to death."

TABLE IV.

Name of Cow.	Date of Calving.	Age.	Quantity of Milk.	Average Fat.	Average Solids-not-Fat.	Period in Milk.
		years.	gal.	per cent	per cent	days.
Eske						
Hetty	April 16th, 1914	4	1,120	—	—	273
"	May 5th, 1915	5	1,501	3.50	8.80	311
"	June 1st, 1916	6	1,496	3.27	8.90	254
"	April 21st, 1917	7	2,575	3.36	8.92	410
Hedges						
Moss Rose	April 10th, 1914	4	933	—	—	259
"	April 1st, 1915	5	1,219	3.29	8.36	289
"	March 7th, 1916	6	1,308	3.46	8.45	266
"	Feb. 3rd, 1917	7	1,642	3.54	8.38	279
"	Jan 10th, 1918	8	1,349	3.59	8.42	243

The preceding table gives the successive milking records of two of these cows, selected not because they are exceptional, but because they are two of the foundation cows and have still a great future.

Eske Hetty calved again in October, 1918, and Moss Rose in January, 1919.

It is known that both cows passed through a complete lactation period previous to the periods recorded in the above table, and it is very probable that they had completed two lactation periods before they came into the herd. Four of Moss Rose's heifer calves are still in the herd, and a fifth, a bull calf, was sold recently. One of Eske Hetty's calves died before it was a year old, but the others are still members of the herd. It is interesting to note that, contrary to expectation, the quality of Moss Rose's milk improved as the yield increased.

The results obtained are a striking testimony to the value of systematic milk recording and careful management. They show that even a herd giving the remarkably good average of 1,000 gal. per cow is capable of considerable improvement; and an increase of over 300 gal. per cow in three years is really a remarkable achievement.

Quality of Milk.—Friesian milk has the reputation of containing a rather low percentage of fat, although the evidence advanced in connection therewith is somewhat meagre. It is quite clear, however, from the results obtained from the Saltcote herd, that although there may be outstanding exceptions, the milk of the average Friesian is not so rich as that of the average pedigree dairy shorthorn. At the same time the milk is not so poor as is generally supposed. The inferiority compared with the shorthorn is not marked, and provided the intervals between milkings are not unreasonable there is no difficulty in keeping the morning's milk above the standard of 3 per cent. of fat. The cows are milked at 4.0 a.m. and 2.0 p.m., giving intervals of 14 and 10 hours. The average percentage of fat for the three years under review has been: 1915, 3.67 per cent.; 1916, 3.64 per cent.; and 1917, 3.63 per cent., the mean of these three figures being 3.65 per cent.

Table V. gives the average percentage of fat in the milk of different breeds of cows in this country, in the United States, and in Holland, according to various authorities.

It would appear from the table that the quality of the milk given by the Friesian cow in this country and in the United States is considerably better than in her native home in Holland. This is an exceedingly interesting fact, and seems to lend support to the contention that the more liberal use of oil cakes in the rations in this country and in the United States may be

TABLE V.—*Percentage of Fat in the Milk of different Breeds of Cows.*

Breed.	Aylesbury Dairy Co., Droop—Richmond.	Ingle.	New Jersey State Agric. Expt. Stn.	Bonnema (Holland).	Bell.	Fleischmann.	The Writer.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Dairy Shorthorn ..	4.03	4.00	3.65	—	3.02	—	—
.. Jersey ..	5.66	5.60	4.78	—	5.13	—	—
Avshire ..	—	3.60	3.68	—	4.24	—	—
Friesian or Holstein	—	3.40	3.51	3.00	3.75	3.23	3.65

responsible for the improvement. It is not the intention of the writer to suggest that the quality of the milk can be varied by feeding. It is, however, very difficult to provide an adequate ration for such heavy-milking cows as those of the Friesian breed unless considerable quantities of concentrated feeding-stuffs are available. The relative prices of dairy produce and concentrated feeding-stuffs in Holland do not encourage the use of artificial feeds to the same extent as in the United States and this country.

The doubtful reputation of the Friesian cow, or, as it is more popularly called, the Dutch cow, in Essex, is probably due to improper feeding. The majority of the herds are mixed herds containing a fair proportion of Dutch or cross-bred Dutch cows. Generally speaking, the Dutch cows are by far the heaviest milkers in the herd, and as the general practice is to give all the cows the same rations, it is usual to find that the 5-gal. Dutch cow is receiving the same amount of concentrated feeding-stuffs as the 2- to 2½-gal. cow. Usually the ration is only adequate for a 2-gal. cow, with the result that the heavy-milking Friesian or Dutch cow cannot maintain her condition, and poor milk is the result. Considerably over 1,000 samples of milk drawn from all parts of Essex are examined annually by the writer, and the general opinion formed is that the average quality of the milk is little, if at all, superior to that produced by the Friesian herd dealt with above.

Variation in Yield and Quality due to Period of Lactation.—Table VI. illustrates the variation in the yield and quality of the milk of Mr. May's Friesians throughout the lactation periods. The variations are also shown graphically in Fig. 5

TABLE VI.—*Variation in Yield and Quality due to Period of Lactation.*

Period.				Yield.	Average Fat	Average Solids-not-Fat.
				lb.	per cent.	per cent.
1st month	..	..	..	1,459	3.64	8.99
2nd "	..	..	..	1,459	3.44	8.89
3rd "	..	..	..	1,354	3.48	8.90
4th "	..	..	..	1,264	3.39	8.73
5th "	..	..	..	1,160	3.61	9.00
6th "	..	..	..	1,076	3.62	8.79
7th "	..	..	..	1,003	3.66	8.75
8th "	..	..	..	852	3.80	8.70
9th "	..	..	..	713	3.92	8.85
10th "	..	..	..	494	3.82	8.77
11th "	..	..	..	274	3.82	8.88

In the above table, the results from the three complete lactation periods are incorporated. The results from each of the lactation periods are strictly comparable with the above table, in fact any one of the sets of figures could be taken as representative of the results obtained from the other two. In this particular herd the cows do not show an increased yield during the second lactation month. This is not in accordance with general experience, and may be a peculiarity of the Friesian breed. After the second month, the decrease in yield is steady and consistent. In general, the percentage of butter-fat tends to increase as the lactation period advances, but there is a curious irregularity in the monthly record (Fig. 5). There is a decided drop in the quality of the milk during the second lactation month, and a slight improvement during the third month, quite in keeping with previously recorded experience. In the fourth month, however, the milk is at its poorest, and it is significant that this occurs in the results for each separate lactation period. The fall in the percentage of butter-fat during the fourth month would be comprehensible if the majority of the cows calved in December or January, when the effect of the flush of grass in increasing the flow of milk during April and May would have a decided tendency to depress the percentage of fat during the fourth lactation month. The calving dates, however, do not admit of this explanation, and the fact that the milk yield is quite normal during the fourth lactation month (see Fig. 5) is strong evidence against such a contention.

Ingle in his book on "Elementary Agricultural Chemistry," p. 189, gives a table illustrating the variations in the per-

centages of fat and solids-not-fat due to the period of lactation. He notes that in the second month the percentage of fat diminishes and gradually increases from the third month onwards. No figures are, however, given for the fourth month. It would seem from the figures given in Table VI. that with Friesian cows the improvement does not begin until the end of the fourth month. Ingle's table also shows a continuous improvement in the percentage of solids-not-fat from the second month onwards. The results recorded above with Friesian cows do not confirm these findings. They seem to suggest that the percentage of solids-not-fat in the milk of Friesian cows does not vary according to either the milk yield or the period of lactation.

The Butter and Cheese Yield of the Friesian Cow.—Although the percentage of fat in the milk of the Friesian cow may not be quite so high as in other breeds, yet the large quantity of milk which the breed produces gives it first place amongst the British breeds of cattle for butter production.

The value of the breed for the production of cheese depends, from the point of view of quality of the milk, upon the percentage of solids-not-fat as well as fat. In this connection Table VII., which gives the percentage of solids-not-fat in the milk of various breeds of cows, as determined by various persons, is of interest.

TABLE VII.—*Percentage of Solids-not-Fat in the Milk of Different Breeds of Cows.*

Breed.	Aylesbury Dairy Co., Droop—Richmond.	New Jersey State Agric. Expt. Stn.	Ingle.	Bell	Bonnema (Holland)	Flora Immann	The Wutter
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Shorthorn	8.87	8.80	8.80	8.86	—	—	—
Jersey	9.23	9.56	9.70	9.22	—	—	—
Ayrshire	—	9.02	9.40	9.22	—	—	—
Friesian or Holstein	—	8.61	8.90	8.65	8.50	8.68	8.76

The percentage of solids-not-fat in the milk of the Friesian cow appears to be about equal to that of the shorthorn. The figures given above indicate that, as in the case of fat percentage, the proportion of solids-not-fat obtained from the Friesian cow in foreign countries is considerably better than in her native home.

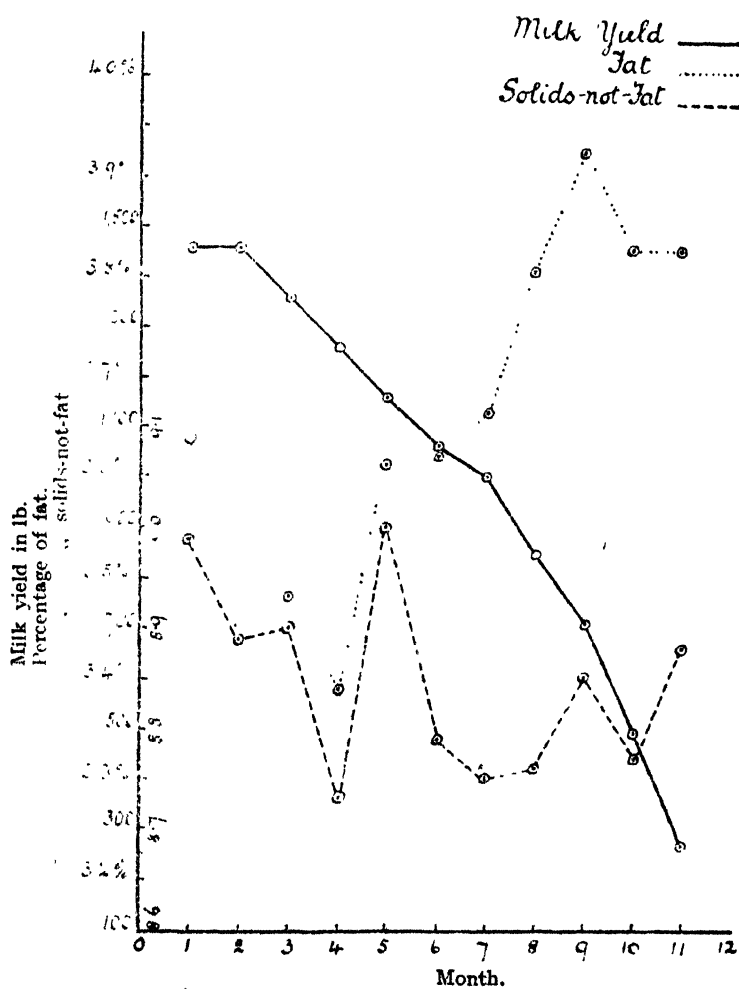


FIG. 5.—Graph showing the variation in the yield and quality of the milk of the cows during three lactation periods.

From trials with Cheddar cheese at the East Anglian Institute of Agriculture, the writer finds that for every 1 lb. of total solids in the milk 77 lb. of cheese is obtained. Table VIII. gives the average amount of fat and total solids in lb. produced per cow for the three lactation periods, and the amount of cheese and butter which could have been obtained. In calculating the amount of butter produced, it is assumed that the butter contains 85 per cent. of fat and the separated milk 1 per cent. of fat.

TABLE VIII.—*Average per Cow.*

—	Fat.	Butter.	Value at 2s. per lb	Total Solids.	Cheese	Value at 1s 4d. per lb.
	lb	lb.	£ s.	lb	lb.	£ s.
1915 ..	381.1	436.0	43 12	1,208.13	999.70	66 13
1916 ..	404.4	462.1	46 4	1,372.00	1,056.07	70 0
1917 ..	477.1	538.0	53 16	1,652.87	1,272.70	84 17
Average for 3 yrs.	420.0	478.7	47 17	1,441.33	1,109.82	74 0

In calculating the values given in columns 3 and 6 above, no allowance has been made for the value of the separated milk, butter-milk, or whey. The figures, however, are sufficient to show the great possibilities of the British Friesian cow for cheese or butter production.

It should be pointed out that all the cows in the herd have been bred in this country, and that none of them is in any way related to any of the animals imported in 1914.

Feeding and Management of the Herd.—The calves are separated from their dams when four days old and receive 2 gal. of milk a day until two months old. From two months until they are three months old, the milk is gradually reduced to 1 gal. a day, the total bulk being kept up to 3 gal. by the addition of warm water. From three months onwards, the milk is further reduced, until at the end of four months it is stopped altogether. From one month onwards the calves receive a handful of oats per day, increasing gradually to 1½ lb. per head when six months old. In the winter, when the calves are six weeks old, a few mangolds are given, the amount being gradually increased till they are receiving 30 lb. a day at six months old.

The heifer calves from six months till three years of age are out-wintered in the meadows, usually without the use of a

shelter shed. The yearlings receive about 40 lb. of cut mangolds and 6 lb. of hay per head per day during the winter, and no cake or meal of any sort during the spring and summer. The two-year-old heifers receive 12 lb. of hay per head per day during the winter, the hay being carted out to them in the meadows daily. The heifers usually calve when three years old, and, when well forward in calf, they receive in addition to the hay 3 lb. of oats and 1 lb. of bean meal per head daily for the two months previous to calving.

The system of management outlined above has been most successful. Strong, hardy, well grown heifers with excellent constitutions have been reared, with the result that when they calve they not only leave big healthy calves, but they milk well. Only two heifers have given less than 700 gal. of milk with their first calves.

Until six months old the bull calves receive the same rations as the heifer calves. At this period, however, $\frac{1}{2}$ lb. of linseed cake, increasing to 1 lb., is added to their ration, and the oats gradually increased to 3 lb. per head per day at one year old.

The stock bulls receive as a winter ration 80 lb. of mangolds, 8-10 lb. of hay, and 4-6 lb. of oats; whilst in the summer the mangolds and hay are replaced by cut grass and lucerne.

During the three years under review, two slightly different rations for the cows have been practised. Until the end of the winter, 1916-17, the following winter rations per head per cow were fed:—

<i>October to Christmas.</i>		<i>Christmas to end of April.</i>	
50 lb. of Kohl Rabi.		50 lb. of Mangolds.	
10 „ Oat Chaff (glumes).		10 „ Oat Chaff (glumes).	
2 „ Oats.	} per gal. of milk.	2 „ Oats.	}
1 „ Bean Meal.		1 „ Bean Meal.	

The only concentrates fed were oats and bean meal, 3 lb. of the mixture being given for each gallon of milk. Thus an 8-gal. cow received 16 lb. of oats and 8 lb. of bean meal per day during the time she gave that quantity of milk.

In the summer, from 1st May till the middle of October, the only artificial feed the cows received was 1 lb. of the mixture per gallon of milk. During the last week in June and the whole of July, the cows are given a forkful of tares each, approximately equivalent to 15 lb. per head per day.

From the last week in August until the middle of October, when the winter rations commence, each cow received 1 bush. of chopped green maize per day.

In the winter of 1917-18 the above rations were altered as follows :—

<i>Middle of October to Christmas.</i>		<i>Christmas till 1st May.</i>	
60 lb. of Kohl Rabi.		84 lb. of Mangolds.	
1½ „ Oats.	} per gal. of	1½ „ Oats.	{
2 „ Bean Meal.		2 „ Bean Meal.	
	Milk.		

This ration is somewhat exceptional, inasmuch as it does not include any straw or hay. Previous experience showed that the cows were not able properly to digest such a strong bean meal mixture as the above, but by increasing the quantity of roots and eliminating the chaff this difficulty was overcome, and the above winter ration was fed with excellent results, as the average of 1,334 gal. per cow for the 1917 lactation period testifies. The summer feeding during 1918 remained the same as before, with the exception that 1 lb. of the new mixture of oats and beans was given per gallon of milk instead of 1 lb. of the old mixture.

These rations for the dairy cows show that it is possible to produce milk and to maintain an exceptionally heavy milking herd of cows on home-grown feedings-stuffs alone. The ration is deficient in protein when judged by the Kellner feeding standards. Nevertheless, the condition of the cows has been excellent throughout, a fact remarked upon by all who saw the herd.

Dry Cows.—When the cow's milk yield drops to less than 20 lb. per day she is placed on the "dry" ration, which, during the winter, is as follows (the mixture being equivalent to that supplied to a 1½-gal. cow) :—

50 lb. of Mangolds.
2½ „ Oats.
3 „ Bean Meal.

This ration is continued until 14 days before calving, when the bean meal is stopped, 4 lb. of oats substituted and a little meadow hay provided. The above rations have proved exceedingly satisfactory. An attempt was made to substitute a cheaper ration containing decorticated cotton cake, ground-nut cake, and linseed cake. It was found, however, that several of the cows did not care for these concentrated feeding-stuffs, and much preferred the oats and bean meal mixture. No doubt, this initial difficulty could have been overcome, but it was felt there was something to be gained by giving the cows the feed they found most palatable.

Cost of Winter Feeding per Gallon of Milk.—Taking mangolds at £1 per ton, oats at £16 5s. per ton, and bean meal at £30 per

ton, the food cost of winter milk per gal. works out as follows :—

TABLE IX.

—	8-gal. Cow.		6-gal. Cow.		4-gal. Cow.		2-gal. Cow.	
	lb.	d.	lb.	d.	lb.	d.	lb.	d.
Mangolds at at 0.2d. per lb	84	8.40	84	8.40	84	8.40	84	8.40
Oats at 1.75d. per lb ..	12	21.00	0	15.75	6	10.50	3	5.25
Bean Meal at 3.21d. per lb.	16	51.36	12	38.52	8	25.68	4	12.84
Total Cost ..		80.76		62.67		44.58		26.49
Cost of food per gal. of milk ..		10.1		10.4		11.1		13.2

The above figures take into account the cost of feeding only, they do not indicate the cost of production, for the calculation of which many other factors, such as labour, interest on capital, depreciation, etc., must also be taken into account.

Cost of Rearing Heifers.—Up to the present, all the heifer calves have been reared with a view to ultimately entering the dairy herd. On p. 146 is an estimate of the cost of rearing a heifer calf from the date of birth until she enters the dairy herd at approximately three years of age. In making this estimate the cost of mangolds is taken at £1 per ton, oats at £16 5s. per ton, bean meal at £30 per ton, meadow hay at £7 per ton, and pasturage at £2 per acre. It is assumed that the calf is born in December and calves at three years old.

All the feeding-stuffs have been valued at market price, and not at the cost of production, the point at issue being whether turning the home-grown feeding-stuffs into milk is or is not more profitable than marketing them.

Considering the herd was only started five years ago, and that the foundation cows were bought at ordinary market prices and had no milk records behind them, the results achieved are highly satisfactory. The rapid progress made is due to the fact that the owner is practically his own stockman and personally supervises all the operations connected with the dairy herd. He is thereby able to ensure that the plan of management outlined in this article is methodically carried out. So great is his belief in the capabilities of the Friesian cow that he is quite confident he will beat his record of owning the first cow to give over 2,000 gal. of milk in a lactation period (262 days), by breeding a 3,000-gal. Friesian cow.

<i>December to April.</i>				£	s.	d.
110 gal. milk at 1s. 6d. per gal.	..	..	..	8	5	0
Oats, average of 1 lb. per day for 6 months, 180 lb.						
at 1 75d. per lb.	..	..	..	1	6	3
<i>April to October.</i>						
Pasturage, $\frac{1}{2}$ acre at £2 per acre	..	..	..	1	0	0
<i>October to April.</i>						
7,200 lb. of mangolds at 0·1d. per lb.	..	..	..	3	0	0
1,080 lb. of hay at 0·75d. per lb.	..	..	..	3	7	6
<i>April to October.</i>						
Pasturage, $\frac{3}{4}$ acre at £2 per acre	..	..	..	1	10	0
<i>October to April.</i>						
2,160 lb. of hay at 1·75d. per lb.	..	..	..	6	15	0
<i>April to October.</i>						
Pasturage, 1 acre at £2 per acre	..	..	..	2	0	0
<i>October to December.</i>						
2 months' special feeding before calving.						
Hay, 720 lb. at 1·75d. per lb.	..	..	..	2	5	0
Oats, 180 lb. at 1·75d. per lb.	..	..	..	1	6	3
Bean Meal, 60 lb. at 3 21d. per lb.	..	..	..	0	16	0
Labour, 3 years	..	..	..	10	0	0
Service fee	..	..	..	5	0	0

The writer wishes to acknowledge his indebtedness to Mr. May for permitting him to make full use of all the particulars and information concerning his herd, and to Mr. George Hobson, the Secretary of the British Friesian Cattle Society, from whom the particulars of the history and origin of the Friesian breed contained in this paper have been obtained.

GRANTS IN AID OF AGRICULTURAL EDUCATION AND RESEARCH IN ENGLAND AND WALES.

THE Board have recently issued in amended form their Regulations for Grants in Aid of Agricultural Education and Research in England and Wales.* The most important alterations relate to grants to Local Authorities, the classification

* Price 2d. net. To be purchased through any bookseller or directly from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2.

of whose expenditure for purposes of aid has been greatly simplified. There are now only two classes of expenditure, viz. :—(1) Salaries and expenses of organisers, and (2) all other approved expenditure; the first will earn a grant of four-fifths, and in respect of the second a grant of two-thirds will be paid. Further, the Residue Grant or “ Whisky Money ” will no longer be taken into account, and the Board's grants will be a definite proportion of the approved expenditure without deduction on this account. The condition which formerly required a certain proportion of the expenditure to be met from the rates is also abolished; and, lastly, the provision for payment of grants on old scales has been withdrawn. The following are the Regulations in detail :—

Agricultural Education Provided at Approved Institutions.—Grants will be made to approved Institutions in aid of expenditure incurred in—

- (a) Providing instruction in agriculture and allied subjects.
- (b) Investigating agricultural problems.
- (c) Advising agriculturists with regard to technical matters.
- (d) Advising and assisting Local Education Authorities in providing agricultural education.

The grants will be in respect of the academic year ending 30th September.

Where the Institution is not a constituent part of a University or University College it must be under the control of a Governing Body, which should include representatives of Local Education Authorities and of such other bodies as the Board may in each case consider desirable; and its constitution must be such as to prevent the possibility of its becoming a source of profit to the Governing Body or to any person connected with it.

In awarding grants under this chapter, the Board will have regard to the whole of the expenditure on agricultural education provided by an Institution, with the following exceptions :—

- (a) Expenditure on external instruction provided by the Institution on behalf and at the cost of a Local Education Authority as part of its scheme of agricultural education.
- (b) Expenditure on special classes in agriculture, horticulture, or nature study for teachers employed in schools in receipt of aid from the Board of Education. Such courses are aided by the Board of Education.
- (c) Expenditure on work in respect of which special grants may be made by the Board.

The Board are urging these institutions to provide higher salaries so as to attract and retain efficient teachers. It is also being suggested to them that they might, with advantage, expand their present provision for field demonstrations and experiments.

The courses of study at these collegiate institutions were very much interrupted during the War, and it is possible that

the complete re-establishment of a regular and permanent organisation may be postponed by the extraordinary demand for training in agriculture due to this long interruption.

Provision of Technical Advice for Agriculturists and the Investigation of Local Problems.—Additional grants will be paid to certain approved Institutions to enable them to extend and to develop the provision of technical advice for agriculturists.

The Board will generally require to be satisfied that the expenditure of an Institution in receipt of grant under this paragraph on work of the type to be aided is greater than it was in the year ending 30th September, 1911, by a sum not less than the amount of the grant.

A special staff must be appointed to carry on the advisory and investigation work for which the grant is made, and in the case of any new appointments the names and qualifications of the officers it is proposed to employ must be submitted to the Board for approval.

Each Institution in receipt of a grant under this head must undertake advisory and investigation work in a group of counties designated by the Board, and assist and co-operate with the Local Education Authorities in the advisory, experimental, and demonstration work carried out by their officers.

Application for the renewal of this grant should be made annually not later than 31st July in each year, and should be accompanied by an estimate of the expenditure to be incurred by the Institution in the 12 months beginning on the following 1st October.

A full report on the work specially aided by the grant must be submitted after the close of each academic year and in any case not later than the 15th November.

Under the Board's Advisory Scheme special advisory officers are appointed by various institutions to undertake local investigations and provide technical advice for farmers in the areas associated with the institutions. The work of these officers is intended to supplement the activities of the County Agricultural Staffs (see below), who are invited to refer to the Collegiate centre any problems requiring more specialised knowledge or *ad hoc* investigation.

While in some cases members of the staff are wholly engaged in this important duty, in other cases it is combined with teaching. It is now the policy of the Board to induce colleges to free their advisory officers from routine teaching; and it is hoped to increase their number and extend their functions to fields of work not now occupied.

Agricultural Education Wholly or Partially Provided by Local Education Authorities. Expenditure on all forms of agricultural education wholly or partly provided by Local Education Authorities is eligible for aid under these Regulations, except expenditure incurred on—

- (a) Education provided in Elementary or Secondary Schools.
- (b) Courses for the training of teachers employed in schools and classes receiving aid from the Board of Education.

- (c) Instruction aided by the Board of Education under the Regulations for Technical Schools, etc., in force from 1st August, 1914, or any Regulations which may subsequently be issued in place thereof.

Under the Regulations for Technical Schools, etc., the Board of Education will continue to aid all courses for instructing teachers in schools and classes aided by that Board, but subject to this they will not aid—

- (1) Courses intended for students over 16 or 17 in which the instruction given is chiefly in technical agricultural subjects. Gardening will be regarded as a technical agricultural subject if taken in a course planned for students over 16 or 17.
- (2) Courses given as part of his staff work by a teacher recognised by the Board of Agriculture and Fisheries as a member of a county agricultural staff or of the staff of an agricultural college.

In order to be eligible for grant, the instruction provided must be efficient in all respects, suitably qualified teachers must be employed, registers in the form provided must be carefully kept, and all necessary returns and information* promptly supplied.

In order that the cost of providing agricultural education by Local Authorities may be properly ascertained, each Local Authority will be required to furnish for the financial year, in such form or forms as the Board may, from time to time, prescribe, a statement of its payments and receipts in respect of agricultural education.

The work of agricultural education in each county must be under the direction of a separate committee, which may be an Agricultural Sub-Committee of the Education Committee, an Agricultural Education Committee of the County Council, or a Committee appointed jointly by a group of counties.

The Committee should include local agriculturists or other persons directly interested in agriculture.

A copy of the Minutes of the Proceedings of the Local Authority in regard to Agricultural Education should be forwarded for the information of the Board as soon as possible after each meeting.

Each county applying for a grant must submit a scheme providing for the systematic organisation of all agricultural education within its area, and the Board may withhold or substantially reduce any grant which would otherwise be payable if the agricultural education actually provided in accordance with such scheme is in their opinion insufficient or is otherwise unsatisfactory.

The grant payable by the Board in respect of the agricultural education provided by Local Authorities will be based mainly on a consideration of the cost and efficiency of the education provided in the financial year ending 31st March.

(a) No expenditure which has not been approved by the Board will be eligible for grant.

(b) An estimate of the expenditure to be incurred in the ensuing financial year must be submitted to the Board in a prescribed form not later than 31st December *preceding*.

* See Memorandum A.48/E—Procedure relating to annual grants in respect of Agricultural Education provided by Local Education Authorities.

(c) Grants on the scale hereinafter set forth will be payable on the net expenditure* chargeable to the Higher Education Account, but shall exclude all expenditure of a capital nature and chargeable to Capital Account. Expenditure of the latter description shall be aidable on such conditions as may be applicable in each case.

(d) All variations in or additions to the approved estimate of expenditure shall be notified to the Board and the Board may refuse to approve any expenditure not so notified.

(e) Subject to the conditions set forth in these Regulations the grants payable by the Board will be calculated as follows:—

- (1) On the salary and expenses of the Agricultural Organiser, 80 per cent.

(NOTE.—The expression "Agricultural Organiser" designates the principal administrative officer in charge of Agricultural Education, provided that the Board are satisfied that he is technically qualified to give instruction and advice in agricultural subjects.)

- (2) On all other expenditure on Agricultural Education and the administration thereof, 66½ per cent.

Where the cost of an Institution providing Higher Education in Agriculture is wholly borne by the Authority, the grant (if any) payable under the regulations on p. 147 will be deducted from the aggregate amount calculated as above.

If in any case the expenditure incurred for any purpose cannot be accurately ascertained, the Board may, after due inquiry, fix such amount as appears reasonable and their decision shall be final.

Grants in Aid of Approved Capital Expenditure. The foregoing provisions apply to grants in aid of the annual maintenance of all descriptions of Agricultural Education. The following conditions apply to grants in aid of approved capital expenditure:—

- (a) In the case of the provision, improvement or extension of a Farm School or Farm Institute a grant will be payable by the Board which will not exceed 75 per cent. of the total approved cost including cost of equipment, and no further sum by way of annual grant will be paid in aid of capital expenditure of this nature. For the purpose of this grant the Board will not contribute to any expenditure for which their approval has not previously been specifically obtained, or which in their opinion is excessive or unnecessary.
- (b) No grant will be made in respect of the acquisition of land as a site for the erection of a Farm School or Farm Institute unless the land is of freehold or long leasehold tenure. Where land is acquired partly for such purpose and partly for a farm to be used in connection with the Farm School or Farm Institute or for any other purpose, the apportionment of the cost of acquisition between the several portions shall be subject to the approval of the Board.

* The expression "net expenditure" means the actual payments on account of Agricultural Education after deducting all receipts other than from Rates or Government Grants.

In the case of a farm maintained by an Authority the Board will have regard not only to the net expenditure as defined above, but also to the cost of maintaining the farm based on a Profit and Loss Account.

- (c) No grant will be payable in respect of the capital cost of acquiring, stocking or working a farm or demonstration holding. The net cost of maintaining any such farm or holding may, however, be included in the annual accounts of the Authority, and will, if approved, be recognised for grant at the rate of 66½ per cent. Sums payable by way of interest and sinking fund charges on loans incurred to provide the capital required for the purposes mentioned may be charged to the Farm Account.

Like the courses of study at colleges the county system of education suffered as a result of the War. It is now, however, to be restored and extended, and it seems likely that in view of the revised regulations for county work given above the grant to counties will be more than doubled in the aggregate, and in a few cases the increase may be even greater.

Local Authorities have been asked to prepare a comprehensive and satisfactory scheme of agricultural education for their areas by means of—

(a) The establishment and maintenance, or contributions towards the establishment and maintenance of an institution for higher agricultural education.

(b) The provision of a county staff of agricultural instructors, including particularly the appointment of an agricultural organiser (at present there are some 40 agricultural organisers).

(c) The establishment and maintenance, or contributions towards the establishment and maintenance of a farm institute or farm school.

(d) The provision of technical advice for farmers.

(e) The provision of regular short courses of instruction at an approved centre or centres.

(f) The provision of local courses, lectures, practical demonstrations, etc., through the agency of the County Agricultural Staff or otherwise.

Agricultural Research.—Grants will be made by the Board in aid of the maintenance of certain approved Research Institutes and in aid of such other research work as they may from time to time approve.

The subject of any research aided under these Regulations must be connected with agriculture or rural industries as defined by the Development and Road Improvement Funds Act, 1909.*

* The Development and Road Improvement Funds Act, 1909, provides that the Development Fund is to be used, *inter alia*, for "aiding and developing agriculture and rural industries by promoting scientific research, instruction and experiments in the science, methods and practice of agriculture." The expression "agriculture and rural industries" is defined as including "agriculture, horticulture, dairying, the breeding of horses, cattle and other live stock and poultry, the cultivation of bees, home and cottage industries, the cultivation and preparation of flax, the cultivation and manufacture of tobacco, and any industries immediately connected with and subservient to any of the said matters."

Agricultural Research Institutes.—Where an Institute has, in the past, been engaged in research in the subject for which a grant is made, the Board will require to be satisfied that the expenditure on work of the type to be aided is greater than it was in the year ending 30th September, 1911, by not less than the amount of the grant.

The Board's grant will not usually fall below two-thirds of the expenditure of the Institute as shown in its audited account, less any receipts from sales of materials, produce, and stock, but will not exceed the sum actually required for the maintenance of the Institute.

An application for a grant in respect of the academic year beginning the 1st October should be submitted to the Board on the prescribed form not later than the 31st July preceding.

Each Institute must keep account of the expenditure on the research work in the group of subjects with which it deals. This account must be audited annually by a chartered or incorporated accountant, and should be for the twelve months ending on the 30th September in each year.

An application for the payment of the grant for the twelve months ending on the 30th September should be made as soon as possible after that date, and should be accompanied by a certified copy of the audited account referred to.

The Board will be willing to make payments on account of the grant, either quarterly or half-yearly, in cases in which they are satisfied that such payments are necessary.

The appointment of the staff of an Institute will rest with the Governing Body, but the Board will require to be satisfied that the persons to be appointed possess suitable qualifications for their work.

A General Report on the work of the year must be submitted to the Board not later than 15th November.

In awarding a grant, the Board will not as a rule be prepared to take into account expenses incurred by the Institute in publishing the results of research either in book form or in the form of periodical scientific memoirs. In the case of expensive publications containing plates which a scientific journal might be unable to accept because of the cost, grants-in-aid of publication may be made, but in such cases an application must be made to the Board before publication is undertaken.

Each Institute will be expected to aid the Board by investigating problems of importance which may urgently require attention, and also to advise the Board from time to time on technical questions relating to its own special subject.

The foregoing Regulations apply to grants in respect of the annual maintenance of approved Institutes. Minor capital expenditure for such purposes as the adaptation or alteration of existing buildings and for the purchase of apparatus will, if approved, be treated as ordinary expenses of maintenance. Applications for capital grants in respect of expenditure which cannot be borne on the annual account must be addressed to the Treasury with a view to a grant being made from the Development Fund, in accordance with the prescribed Regulations (Statutory Rules and Orders, 1910, No. 592).

As regards Research Institutes the policy pursued by the Board is to concentrate research on a particular subject so far as possible at a single institution, and developments with a

view to secure a greater degree of co-ordination of work on related subjects are now under consideration ; in particular, research work on phytopathology is being concentrated at Rothamsted. In recent years grants have been made to fifteen institutes for research in plant physiology and pathology, plant breeding, plant nutrition and soil problems, fruit growing, glasshouse crops, animal nutrition, animal pathology, poultry and rabbit breeding, dairying, zoology and agricultural economics.

Special Grants for Agricultural Research.—The above Research Institutes are permanently organised for the purposes of research, and the substantial grants which the Board make provide the whole or the larger portion of the cost of maintenance. Grants are, however, available for encouraging research at other institutions with the object of investigating specific problems. These grants are not ordinarily available for providing the salaries of investigators and are intended to provide for special and incidental expenses.

The following rules have been made by the Development Commissioners to regulate the conditions under which Special Research Grants shall be given :—

- (a) Grants will only be made in respect of some definite subject of research (the duration of which is not expected to extend over more than three years) to be carried on in connection with a University, University College or other approved Institution or Society in Great Britain or Ireland. In the event of an application being made by an individual, it must be supported by a recommendation from the authorities of the Institution in connection with which the research is to be carried on, and accompanied by an undertaking that the necessary facilities for the work will be given.
- (b) The subject of research must be connected with agriculture and its allied industries. The application shall be made either to the Board of Agriculture and Fisheries, or to the Board of Agriculture for Scotland, or to the Department of Agriculture and Technical Instruction, Ireland ; the application must state fully the nature of the proposed research, the methods to be adopted, and the names and qualifications of the staff by whom the work is to be undertaken, and must be accompanied by a detailed estimate of the cost.
- (c) Grants will be made for one year only, from 1st October to 30th September following. If it is proposed to continue the investigation after the expiry of the year, a fresh application must be made.
- (d) Applications will be referred (through the Treasury) to the Advisory Committee on Agricultural Science appointed by the Development Commissioners, and the latter, if they accept the recommendation of the Committee, will recom-

mend to the Treasury that the grant approved shall be made from the Development Fund to the Government Department concerned. Payment of the grant will be made by the said Department on such conditions as to accounts, etc., as it may from time to time prescribe, and the said Department shall have power to sanction variations in the approved estimates, provided that an increase in the total grant sanctioned is not thereby entailed.

- (e) No special grant shall ordinarily be made to a Research Institution aided by grants from the Development Fund except in connection with an investigation lying outside the main group of subjects in respect of which a grant is made to the Institution, and then only on condition that the work proposed can be undertaken without undue interference with the principal work of the Institution.
- (f) No grants will ordinarily be made for the routine apparatus, reagents, and other appliances which a reasonably equipped laboratory should provide. Grants may be made for expensive apparatus or other materials which may be specially required, but in that case the apparatus will remain the property of the Department concerned, to be returned to them at the conclusion of the investigation.

Grants will not ordinarily be made in respect of land, permanent buildings or fittings. If the investigation necessitates the maintenance of live stock, the cost will be ascertained on the basis of a Profit and Loss Account in the usual form.

- (g) A report (not necessarily for publication) on the progress of the investigation must be furnished to the Department concerned in respect of each investigation not later than three months after the expiration of the period for which the grant is made. A copy of this report shall be transmitted to the Development Commissioners, who will transmit copies of the same to members of the Advisory Committee.
- (h) Detailed accounts and vouchers of the expenditure incurred must be rendered, and payments will only be made in respect of moneys actually expended. Any excess charges over and above the sum authorised must be defrayed by the Institution or individual carrying out the research.
- (i) New applications must be forwarded to the Department concerned before the 15th May previous to the beginning of the academic year in respect of which a grant is asked. Applications for renewal may be submitted up to 15th June.

REDEMPTION OF TITHE RENTCHARGE AND CORN RENTS: THE TITHE ACT, 1918.*

1. The Desirability of Redemption.—It is generally agreed by landowners and titheowners alike that the redemption of tithe rentcharge on reasonable terms is desirable. Redemption saves the landowner the trouble of verifying the accuracy of the demands sent to him half-yearly by the tithe collector, and of having to remit the payments for sums which, in many instances, are very small. It also removes a possible cause of complication and delay in sales and other dispositions of land. The chief advantages of redemption to the titheowner are that it saves him the cost of collection, which in some parishes is considerable, obviates a frequent cause of ill-feeling and litigation, and extinguishes the tithe rentcharge for all purposes, including the payment of rates and taxes.

2. Redemption prior to the Tithe Act, 1918.—Prior to the passing of the Tithe Act, 1918, landowners could enforce redemption as a rule only in cases of tithe rentcharges not exceeding 20s. each in amount. Where a tithe rentcharge exceeded 20s. the landowner usually could not redeem without the titheowner's consent, and, if such a tithe rentcharge was attached to a benefice, the concurrence of the bishop of the diocese and patron of the living was also necessary. Moreover, except in a few special cases, tithe rentcharge was not redeemable for less than twenty-five years' purchase of the par value of the tithe rentcharge. In these circumstances it is not surprising that at the date of the passing of the Tithe Act, 1918, less than 2 per cent. of the tithe rentcharge charged on lands in England and Wales had been redeemed since the commutation in 1836.

3. Redemption without Consents and on Reasonable Terms now Possible.—The Tithe Act, 1918, made important alterations in the law relating to redemption. It provides that a tithe rentcharge of any amount shall, on the application of the owner of the land and without the consent of the owner of the rentcharge, the bishop, or the patron, be directed by the Board to be redeemed unless, owing to any exceptional circumstances, the Board otherwise direct. It further abolishes the minimum limit of twenty-five years' purchase for redemption, and provides that the consideration

* This Article is issued as Leaflet No. 329.

for redemption shall be fixed by an agreement between the landowner and the titheowner, or, in default of such agreement, by the determination of the Board, but this does not apply to any rentcharge with respect to the redemption of which proceedings were pending on the 21st November, 1918. Another important provision of the Act is that which enables the landowner to pay the redemption money by means of an annuity for a period of years not exceeding fifty.

4. Agreements as to the Amount of Consideration for Redemption.—

Section 4 (1) of the Act, which enacts that the amount of the consideration money payable on the redemption of a tithe rentcharge may be agreed by the owners of the land and of the rentcharge, is qualified by Section 4 (3) which provides that no such agreement is valid :—

- (a) if made by a spiritual person entitled in respect of his benefice or cure, except with the consent of Queen Anne's Bounty, or, in the case of a rentcharge affected by the Welsh Church Act, 1914, of the Welsh Church Commissioners ; or
- (b) if made by a person (not being a spiritual person so entitled) who is not empowered to sell the rentcharge unless he obtains the consent of some other person, except with the consent of that other person.

5. In Default of Agreement, Board determine Compensation.—

Section 4 (1) of the Act directs that, in default of an agreement as to the amount of the consideration for redemption the Board, on the application of the owner of the rentcharge, or of the owner of the land or any part thereof, shall determine what is fair compensation for the redemption, in accordance with the method prescribed in the First Schedule of the Act. This Schedule provides that the Board shall estimate the annual sum payable in perpetuity which they consider equal to the variable tithe rentcharge which would be payable if there were no redemption. This estimated annual sum is called the "gross annual value," and the following deductions are directed to be made from it in order to obtain what may conveniently be described as the "net annual value" :—

- (1) the average annual amounts paid or payable by the titheowner in respect of the rentcharge on account of rates and land tax during the three years immediately preceding the date of the application to redeem ; and
- (2) such sum, not exceeding $2\frac{1}{2}$ per cent. of the "gross annual value," as in the opinion of the Board represents the necessary cost of collection of the rentcharge.

The compensation for redemption is such sum as in the opinion of the Board is sufficient, after payment of the cost of investment, to produce when invested in Government securities a permanent annuity equal to the "net annual value."

In the case of an application for redemption made before the 1st January, 1921, the Schedule directs that the "gross annual value" of the rentcharge shall be taken to be the original commuted amount thereof, and that the compensation shall be twenty-one times the "net annual value" obtained from it as explained above.

It will be observed that the amount of the consideration for redemption in any particular case depends largely upon the deductions to be made in respect of rates, land tax and cost of the collection of the tithe rentcharge, and, as these outgoings differ very considerably in different parishes, the consideration for redemption in different parishes will not be by any means uniform.

The following examples of the method of calculating the consideration for redemption may be useful. Assuming (1) local rates and land tax on the tithe rentcharge for the three years immediately preceding the application to redeem to be, say, 5s. and 3d. in the pound, respectively, (2) an average assessment for the three years of £66 for each £100 of tithe rentcharge (par value), and (3) the cost of collection to be $2\frac{1}{2}$ per cent., the consideration money would, in the case of tithe rentcharge attached to a benefice, be arrived at as follows :—

"Gross Annual Value" of £100 tithe rentcharge
(until 1st January, 1921, fixed by the Act) ..

				£100 (par value).		
Deductions—	£	s.	d.	£	s.	d.
Half rate (2s. 6d. in £) on £66 assessment ..	8	5	0			
Land Tax (3d. in £)	0	16	6			
Cost of Collection ($2\frac{1}{2}$ per cent. on £100): <i>see</i>						
First Schedule to Act	2	10	0			
	<hr/>			11	11	6
Net Annual Value				88	8	6

The consideration money = £88 8s. 6d. $\times 21$ = £1,856 18s. 6d., *i.e.*, just over 18½ years' purchase of the par value of the tithe rentcharge, and 17 years' purchase of its present value, *i.e.*, £109 3s. 11d. After the 1st January, 1926, the value of tithe rentcharge will vary from year to year in accordance with the average prices of wheat, barley and oats for the fifteen preceding years.

The consideration money in respect of tithe rentcharge *not* attached to a benefice would be calculated similarly except that the whole rate (5s. in the pound) instead of the half-rate would have to be deducted in arriving at the net annual value of the tithe rentcharge. The consideration money for redemption in such cases would be, on the above assumptions, £1,683 13s. 6d. for £100 par value, or just over 16½ years' purchase, and rather less than 15½ years' purchase of the present value.

6. Provisions for Discharge of Consideration for Redemption by Annuity.—By agreement the consideration for redemption may be an annuity payable yearly or half-yearly for a period not exceeding 50 years. The owner of the land or any part thereof may apply to the Board on or before the 1st January, 1921, for a direction that payment shall be made by means of a similar annuity. Section 4 (2) of the Act provides that the amount of the annuity shall be calculated in the following manner. To interest not exceeding 5 per cent. per annum on the consideration money is to be added such sum as would be sufficient, if the periodical payments thereof were accumulated at compound interest at a rate not exceeding 4 per cent. per annum, to produce an amount equal to the consideration money at the end of the said period. The total of these two sums will give the amount of the yearly or half-yearly payment of the annuity as the case may be.

In any such case the Board by order charge the land with the annuity, and the order will contain such provisions for giving effect to the charge and for protecting the interests of persons interested in the rentcharge.

If the rate of interest on the consideration money were 5 per cent. and the annual amount to be accumulated in order to replace the consideration money at the end of, say, 50 years, were calculated at 3½ per cent. compound interest, the annuity for 50 years required under the Act to discharge the consideration for redemption of £100 tithe rentcharge, if attached to a benefice, would be £108 2s. 6d., and if not attached to a benefice, would be £98 os. 9d.

7. Charges for Redemption Money if not duly Paid.—If the consideration money payable in respect of the redemption of a tithe rentcharge is not paid or discharged within one month after the same becomes payable, the owner of the rentcharge may apply to the Board for an order charging the land with the payment of the consideration money and the costs incurred in obtaining the charge.

8. Priority and Registration of Charges.—A charge created under the provisions of paragraph 6 or 7 will have priority over existing charges, but must be registered under the Land Charges Registration and Searches Act, 1888, in the Land Registry.

9. Provision of Money for Redemption by Limited Owners.—Money applicable to the purchase of land to be settled or held to or on any uses or trusts may be applied in or towards the redemption of a tithe rentcharge which is charged on land settled or held to or on the like uses or trusts.

Limited owners can, with the consent of the Board, charge the redemption money and expenses on the land exonerated.

10. How Liability for Tithe Rentcharge may be ascertained.—Any person may ascertain the liability of his property as regards tithe rentcharge by inspecting the Tithe Map and Apportionment in the custody of the Board; or he can obtain the information by letter on sending to the Board a plan showing the situation of the property, and paying the search charge which in an average case does not exceed 5s. Certified copies of the map and apportionment are deposited in the parish, usually in the custody of the Incumbent and Churchwardens, and with the Registrar of the Diocese, and are open to inspection on payment of a charge of 2s. 6d. (Tithe Act, 1836, s. 64).

11. Procedure where different Properties are jointly charged with same Rentcharge.—If land is not separately charged with tithe rentcharge, but forms part of a larger area, comprising other properties, which is subject to one rentcharge, redemption cannot proceed unless all the owners combine until an altered apportionment has been made fixing a separate rentcharge upon the land proposed to be redeemed. Such altered apportionment is not practicable if it involves the imposition of any rentcharge less than 5s., but in such cases it may be possible to proceed under the provisions referred to in paragraph 16.

12. Expense saved by Application by several Landowners.—Any number of rentcharges taken from the same tithe apportionment may be included in the same application, and proportionately the fee is less in cases where the total amount of the rentcharges included in the application is large. (See paragraph 15.)

13. When the Rentcharge will Cease and be Extinguished.—In cases where the consideration money is discharged by the payment of a lump sum the rentcharge is extinguished

from and after the payment of the half-yearly portion of the rentcharge which shall next accrue due subsequently to the time of the payment of such sum, and in cases where the consideration money is discharged by an annuity, the rentcharge is extinguished after payment of the first instalment of the annuity, and in cases where a charge on the land is created under paragraph 7, after payment of the half-yearly portion of the rentcharge which accrues due next subsequently to the time of the creation of the charge.

14. Issue of Certificate of Redemption.—In cases other than those in which the Board direct the discharge of the consideration money by an annuity when the redemption money has been paid under the direction of the Board to the persons entitled to receive it, a certificate under the seal of the Board is issued, declaring the rentcharge redeemed. The Certificate of Redemption is retained in the custody of the Board, and may be inspected on payment of a fee of 1s. 0d. Any person interested can be supplied with a copy of the certificate on payment of a small charge for the cost of preparing it. .

15. Fees.—The following official fees are payable where the application for redemption is made by the landowner :—

	£	s.	d.
Where the rentcharge does not exceed 1s.	0	5	0
Where the rentcharge exceeds 1s. and does not exceed 2s.	0	7	6
Where the rentcharge exceeds 2s. and does not exceed 3s.	0	10	0
Where the rentcharge exceeds 3s. and does not exceed 4s.	0	12	6
Where the rentcharge exceeds 4s. and does not exceed 5s.	0	15	0
Where the rentcharge exceeds 5s. a fee of 15s. for the first 5s. and for each additional 5s. or fractional part of 5s. to £2	0	5	0
For each 5s. or fractional part of 5s. beyond £2 up to £5	0	2	6
For each £5 or fractional part of £6 beyond £5	0	2	6

16. Applications by a Titheowner or by the Owner of part only of the Land charged with a Tithe Rentcharge.—Where land is charged with a tithe rentcharge of any amount and has been divided since the last apportionment into numerous plots for building or other purposes so that no further apportionment can conveniently be made, application for the redemption of the entire rentcharge may be made under Section 32 of the Tithe Act, 1860, by the owner of any of the plots, or under Section 5 of the Tithe Act, 1878, by the owner of the tithe rentcharge.

Where land is charged with a tithe rentcharge not exceeding 20s., the owner of the tithe rentcharge may apply for its redemption under Section 3 of the Tithe Act, 1878. In cases,

however, where the lands of one landowner in the same parish are charged with rentcharges, which severally do not exceed 20s. but which in the aggregate do exceed that sum, the Board will not, as a rule, be prepared to order the redemption of such rentcharges without the landowner's concurrence.

17. Corn Rents and other Payments under Local Acts, etc.—

The provisions referred to in paragraphs 3 to 9 and 11 to 16, except the method of arriving at the fair compensation for redemption which is explained in paragraph 5, apply to corn rents, rentcharges, and money payments (other than rentcharges payable under the Extraordinary Tithe Redemption Act, 1886) which are liable to redemption under the Tithe Acts, 1836 to 1891. In default of an agreement between the parties as to the amount of the compensation for redemption, the Board under Section (1) of the Tithe Act, 1918, determine what is "fair compensation for the redemption." The Board estimate the annual sum payable in perpetuity which is equal to the corn rent or other payment in question, having due regard to any variation to which the payment may be liable under the local Act or by Order of Quarter Sessions made under the local Act. From the estimated annual sum thus arrived at, the same deductions in respect of rates and land tax, if any, and the cost of collection are made as in the case of the redemption of tithe rentcharge. The net result multiplied by 21 gives the required amount of the consideration.

18. Increment Value Duty.—It having been suggested that the effect of the redemption of tithe rentcharge is to increase the increment value of the land and so render the landowner liable to increased taxation under the Finance (1909-10) Act, 1910, the Board have ascertained from the Commissioners of Inland Revenue that there is no ground for the suggestion.

19. Forms.—The following forms will be supplied by the Board on request :—

- (1.) (a) Instructions for the redemption of tithe rentcharge and corn rents, etc., in cases where the application is made by the landowner (B. 14/C.)
(b) Application for the redemption of tithe rentcharge in such cases (B. 13/C.)
(c) Application for the redemption of corn rents, etc., in such cases (B. 60/C.)
- (2.) (a) Instructions for the compulsory redemption of tithe rentcharge, corn rents, etc., in cases where the application is made by the tithe-owner or by the owner of part only of the land (B. 210/C.)

- (b) Application for the redemption of tithe rentcharge in such cases (B. 9/C).
- (c) Application for the redemption of corn rents, etc., in such cases (B. 212/C).
- (3.) Forms of continuation schedule for use in the redemption of tithe rentcharge or of corn rents, etc., in cases where the schedule provided in the form of application is not sufficient to show all the rentcharges proposed to be redeemed (B. 23/C).

SILVER LEAF IN FRUIT TREES.

DURING recent years fruit growers have suffered very severe losses from the disease known as Silver Leaf. The trouble is particularly common on trees belonging to the order *Rosaceae*, for example, plum, apple, almond, apricot, cherry, peach, nectarine, and Portugal laurel, but trees and shrubs belonging to altogether different orders are also affected. Amongst these may be mentioned currant, gooseberry, horse-chestnut, laburnum, and tree lupin. It is, however, in the plum that Silver Leaf has caused most serious loss, the Victoria variety especially having been attacked and killed in large numbers, so much so that unless drastic measures are taken to prevent the spread of the disease this valuable variety of plum is threatened with extermination.

Description.—As the name implies, the foliage of trees suffering from Silver Leaf develops a silvery or leaden sheen which usually commences in a single branch. After a time the affected branch begins to die back, and as branch after branch becomes attacked large portions of the tree die, and as a general rule the whole tree is ultimately killed. The length of time between the first symptoms of disease and the death of the tree varies with the species or variety, the extent of the attack, and other factors. If affected branches are removed as soon as the first signs of attack are manifest, trees may often be saved, and in a few cases affected trees recover without any treatment whatever. As a general rule, however, unless promptly attended to, the tree inevitably succumbs. After the death of a branch, but not necessarily after the whole tree has died, a purple fungus named *Stereum purpureum* will usually be found pushing its way through the dead bark and forming flat

incrustations (see Fig. 2) or bracket-shaped bodies (see Fig. 3) on the surface of the dead bough and branch. These structures are the reproductive portions of the fungus, and produce innumerable spores. The fungus itself had been present in the wood of the tree for one or more seasons and had been responsible, as explained below, for the silvering of the foliage and the death of the branches, but it was only after the latter had died that it proceeded to develop externally and to produce its fructifications.

Cause of the Disease.—Although much further research is needed as to the nature of Silver Leaf, and many problems connected with it await elucidation, practically all authorities are agreed that *Stereum purpureum* is capable of producing Silver Leaf, and that this fungus is primarily responsible for the disease in plum orchards all over the country. It is not maintained that Silver Leaf is invariably brought about by this fungus, but exceptions are comparatively rare and from the fruit-grower's point of view they are negligible.

The scientific knowledge which is possessed as to Silver Leaf is due exclusively to the work of British botanists, and for the last ten years Mr. F. T. Brooks, of Cambridge, has made the disease a special study. This writer pointed out that the wood of a plum branch possessing silvered foliage practically always shows dark brown or blackish markings when cut across (see Fig. 4), although in the early stages of attack this discoloration is usually considerably below the silvered leaves. Microscopic examination revealed the fact that the discoloured portion of the wood contained the fine threads of fungus mycelium and that the brown colour was due to the presence of a brown gum. Brooks further showed that if portions of the mycelium of *Stereum purpureum* (derived either from naturally-grown specimens or from the fungus grown in pure culture) were inoculated into a healthy plum under conditions which preclude the possibility of infection from other sources, precisely similar mycelium was produced, together with the discoloration of the wood and the formation of gum. The foliage also developed the characteristic silvery appearance. This experiment has been performed over and over again on various kinds of plum and at different seasons of the year with the same result. Inoculations with the spores of the fungus also produced the same effect. No silvering of the foliage, however, occurred if cuts were made but no *Stereum purpureum* inserted, or if some other fungus (such as *Stereum hirsutum*) was employed instead. It is important to note that if the silvered foliage is examined

no mycelium is found in the tissues, nor as a rule is there any in the upper part of the affected branch and twigs, at all events in the early stages of attack. The fungus is confined to the discoloured portion of the wood which occurs lower down, though its effects are seen in the silvering of the foliage. The silveriness itself is found to be primarily due to the accumulation of air below the epidermal cells, much in the same way that, owing to the presence of air, a white streak often shows in a block of ice when it is cracked. The epidermal cells have a tendency to break away from the cells immediately below, and the presence of air interferes with the normal reflection of light from the surface of the leaf.

From correspondence in the horticultural press it is evident that many persons have not appreciated the above facts and are still concerned with theories and speculations as to the cause of Silver Leaf, or occupied with side issues. It should be clearly understood therefore that *Stereum purpureum* is the responsible parasite in the fruit plantations of the country, and that no other theory which has been put forward to account for Silver Leaf in association with the dying back of fruit trees has been proved.

Description of the Fungus.—It is important that growers should learn to recognise the fungus causing the disease, as it may occur on the dead wood of other trees besides plum, and should not be allowed to persist where fruit trees are grown; all wood harbouring it should be cut up and used for firewood.

The fructifications of *Stereum purpureum* are purple-mauve when fresh, often with a white or pale woolly margin, but they change colour with age. In consistency they are leathery. They are very variable in form and appear either as flat incrustations up to several inches long covering the under surface of the branches or on the sides of the trunk (see Fig. 2), or as bracket-shaped projections of $\frac{1}{4}$ -in. to 1-in. in width, and arranged in tiers one above the other (see Fig. 3). In this case the upper surface is hairy, and the under surface smooth. The purple colour, however, is the characteristic feature, and no other fungus of this colour occurs on plum.

The spores are produced in abundance on the smooth under-surface of the fructifications. Although the latter shrivel up in dry weather they are capable of reviving with rain and discharging a fresh crop of spores. In this way the spore-discharge from a given fruit body may last over a long period.



FIG. 1.—Upper part of silvery Victoria Plum tree, one branch of which is dead and bears true-tinctions of *Staccum paupacum*



FIG. 2.—Fructifications of *Staccum paupacum* flat-form on dead branch of Victoria Plum tree



FIG. 3.—Fructifications of *Staccum paupacum* bracket-shaped form



FIG. 4.—Cross section of branch showing diseased wood, dark in colour, and sound wood. Twice natural size.



FIG. 5.—Blenheim Orange Apple tree that has died after being regrafted. The scions also have died and the stock bears fructifications of *Stereum purpureum*.

The fructifications appear at any time of year when the weather is moist and mild, but they are produced in the greatest abundance after the heavy rains of autumn.

Method of Spreading.—The fungus is propagated by the spores which are freely distributed by wind. They germinate readily in moist weather, and the fungus gains admission to the trees through wounded surfaces such as cracked branches, injured trunks, fissures in the bark, and any other unprotected wounds. On germination, a mycelium is produced which first of all attacks the dead and injured tissues, but on gaining strength invades the water-conducting cells and attacks the living part of the tree. It has been shown that infection by spores cannot take place through the sound and uninjured bark.

Where the roots of two trees overlap the mycelium from a diseased root may attack a sound root if in actual contact with it, and thus spread the disease. The mycelium, however, does not spread through the soil itself, but in or along portions of the woody roots. According to Brooks, however, it is not by means of the roots that the disease is generally spread, and in support of this it will be noted that affected trees, for instance in a plantation of Victorias, usually appear scattered about in an irregular manner, and not radiating out from a common centre.

Silver Leaf is especially prevalent in trees which have been cut down and regrafted, and in the case of apples it is as a rule only top-grafted trees which suffer to any large extent. The varieties badly attacked when top-grafted are mostly those which are known to callus poorly, such as Lord Suffield, Lord Grosvenor, Manx Codlin, Ecklinville and Pott's Seedling. The explanation, probably, is that the unprotected cut stump offers exceptional facilities for spore-infection. This infection may not take place immediately, but if it does occur and mycelium develops in the stock it usually spreads to the graft and brings about its rapid death. Fig. 5 shows a case where the fungus obtained an entry soon after grafting and where the scions made little growth.

In connection with spore-infection it should be remembered that the spores which give rise to new infections do not necessarily originate from a tree of the same kind as the one attacked. *Stereum purpureum*, for instance, is often found on laburnum in gardens, and spores from this may bring about Silver Leaf in plums.

Susceptibility of Varieties.—All varieties of plum are liable to Silver Leaf. At one end of the list stands Victoria, by far the most susceptible of all, with Czar (very subject to the disease in certain localities) as second, and at the other end River's Early Prolific and the Yellow Pershore, which are highly resistant. The explanation of the frequency of attack in Victoria has been sought in its heavy cropping powers, which not only weaken the trees, but bring about breaking of the branches, thus affording points of entry for the fungus. This is, however, probably only partly responsible, the true explanation doubtless lying in those subtle factors which govern susceptibility and immunity in all kinds of plants and animals.

The question of the effect of stocks has recently attracted attention and in some quarters it has been stated that Victorias grafted on highly resistant varieties partake of the resistance of the stock. Many trees have consequently been worked recently on the Yellow Pershore Plum, especially in the Evesham district, but whether a permanent beneficial effect has been produced or not is at present uncertain, since the use of this stock on an extensive scale has only been practised for the last ten years. In the case of Victorias it is usually in trees 20–25 years old that Silver Leaf causes such wholesale damage, hence it is too early to form an opinion based on any extensive trials. The Yellow Pershore plum itself is undoubtedly occasionally attacked by Silver Leaf, and, according to reliable growers, Victorias worked on it have, after a time, shown signs of the disease. The whole question of stocks is now under investigation, both from a scientific and practical standpoint, but time must elapse before the results of the investigations become available.

Control Measures.—Although no cure for Silver Leaf is at present known, the following recommendations, if carried out thoroughly, will materially help in checking the spread of the disease :—

1. *Removal of Trees and Cutting out Branches.*—Some growers advocate the removal and destruction of all trees showing silvered foliage; but, judging from experience in Cambridgeshire on a fairly extensive scale, it appears that this drastic treatment is not necessary. If affected trees are systematically and energetically dealt with as soon as the disease appears it is possible very considerably to control its spread. To effect this the following two operations must be rigorously enforced :—

- (a) All dead trees must be grubbed up and destroyed, and also all trees which have begun to die back.
- (b) All silvered branches, even though they show no signs of dying back, must be cut out. It will be remembered that the minute threads of the fungus are usually found in the tissues of the wood considerably further down the branch than the level at which the silvered leaves appear. Silvered branches, therefore, must be cut back to a point where no dark stain in the wood can be found. Unless this be attended to the operation will not be successful and the disease will spread to other branches. It should further be remembered that, as callus-formation takes place much more readily if the branches are cut back close to the main branch or stem, it is advisable, if practicable, to cut back to such a point.

2. *Prevention and Healing of Wounds*.—All wounds made by the removal of branches should be pared over with a knife, and covered *at once* with Stockholm tar. It is important also that wounded surfaces made by the breaking off of branches through wind or other causes should be attended to in the same way, and, in the case of the highly susceptible Victoria, branches which have cracked through heavy crops of fruit should be cut off. Trees should never be injured more than is necessary, and in every case the wound should be immediately protected with tar.

3. *General Measures*.—Accumulations of woody debris must not be allowed. Sawn-off branches and trees that have been grubbed up should be removed from the plantation immediately and be used for firewood. Small branches should be burnt on the spot. If it is necessary to keep the firewood for any time, it should be stored as far away as possible from fruit trees and preferably in a shed. To cut down dead trees without subsequently removing them is useless, and to keep a wood-pile in or near a fruit garden is a practice that cannot be too strongly condemned. If it is quite impracticable to take diseased trees up by the roots they should be cut down close to the ground and the stump covered with at least six inches of soil. Exposed stumps on which the fungus can fructify must never be left.

Drainage also should be attended to. Silver Leaf is believed to make more rapid headway on heavy soils and in damp situations. Any improvement, therefore, in the drainage of an orchard will help the trees to resist the disease.

The application of lime, moreover, must not be neglected. Where the soil is sour through lack of lime, the general health of the trees suffers, and, as a consequence, they more readily fall a prey to disease.

4. *Resistant Varieties*.—Where Silver Leaf is very severe and many trees have had to be removed it is advisable to plant plums other than Victoria or Czar. This applies especially to cases where the ground is surrounded by orchards or plantations in which the disease is still rampant and where the new trees will be in constant danger of spore-infection. Of varieties to be recommended, Pond's Seedling, Monarch, Purple Egg Plum and Damsons are generally fairly resistant, whilst Pershore Yellow Plum, River's Early Prolific and Damascene are extremely seldom attacked.

NOTE.—The Board wish to acknowledge their indebtedness to Mr. F. T. Brooks, M.A., for permission to reproduce the illustrations which appeared in his Article in the *Journal of Agricultural Science*, June, 1913, the blocks of which have been kindly lent by the Cambridge University Press.

(This Article is also issued as Leaflet No. 302.)

ONION SMUT: A DISEASE NEW TO BRITAIN.

A. D. COTTON.

THE occurrence of Onion Smut in Britain is of importance not only on account of the serious nature of the disease itself but as a warning for the need of continual alertness with respect to the introduction of new diseases and the possibility of this being brought about by the use of contaminated seed.

Onion Smut is caused by the fungus *Urocystis cepulae*, Frost. The original wild host of this fungus is not known with certainty, but for the last fifty years it has been the cause of serious disease in the Eastern States of America, and it is usually regarded as of American origin. In Europe isolated outbreaks of Onion Smut have been reported from France, Germany and Denmark, but no record of its occurrence in England has been published. Massée deals with Onion Smut in his work "Diseases of Cultivated Plants and Trees" (1910), but he does not state that the fungus had been recorded as appearing in this country, and it is well known that he included in this volume several diseases not found in Britain. In his subsequent work, "Mildews, Rusts and Smuts" (1913), which is admittedly a British Flora, *Urocystis cepulae*, is not mentioned.

An extensive literature on Onion Smut is to be found in American publications. The disease commenced to be troublesome about 1870, and the first accurate account with a description of *Urocystis cepulae* was published by Farlow in 1877. A particularly full and careful account by R. Thaxter will be found in the Report of the Connecticut Agricultural Experiment Station for 1889. Since that date many bulletins and papers, mostly concerned with control methods, have been published, and a general account will be found in all modern American text books.

With regard to the eradication of the disease, the great difficulty lies in the impossibility of satisfactorily disinfecting contaminated soil. The spores are very long lived, and soil badly contaminated, unless specially treated, is rendered useless for onion growing for many years. For this reason the cultivation of onions over thousands of acres of valuable ground in Connecticut had to be given up.

British Outbreaks.—The history of the outbreaks in Britain is as follows:—Diseased specimens of onions were submitted to the Board from a private garden near Northampton in the beginning of June, 1918. It was at once apparent that the plants were attacked by *U. cepulae*, and a visit was paid to the locality by two of the Board's officers in order to ascertain the extent of the affected area and the amount of damage which had been caused. The bed occupied by the onions proved to be small, and the total number of plants affected was not great—10 to 15 per cent. Many of these, however, were attacked severely and were completely crippled. The owner stated that he had observed the disease the previous season but was not successful in discovering its identity; on its reappearance, however, in 1918, he submitted specimens to the Board. The 1918 bed was in immediate proximity to the infected plot of 1917. The owner was advised carefully to remove and burn all affected plants and to abandon onion growing on the affected soil. Although onions had been cultivated for many years, the disease had not been noted previous to 1917. The introduction of Smut was therefore probably due to the use of contaminated seed.* The seed was bought locally, but efforts to trace the original source of supply were not successful.

* It is necessary to maintain the distinction between "contamination" and "infection." "Contamination" signifies that the fungus or fungal spores are *upon* or *amongst* the seeds, whilst "infection" would imply that the fungus had effected an entrance into the seed, which, in the present instance, is not the case.

The occurrence of the outbreak was at once made public. It was notified to the Board's Plant Disease Sub-Committee and to the honorary correspondents for the Plant Disease Survey. A Press notice was also issued warning gardeners, allotment holders, and others to be on their guard against the presence of a new onion malady. As a result of this action a very large number of onion plants suffering from various diseases, especially *Macrosporium parasiticum* following *Peronospora*, were forwarded to the Board's Advisory Department, but no specimens affected with Smut were received. Since some uncertainty had been expressed with regard to the previous existence of the disease in England, a number of circular letters were sent to growers, inspectors, advisory biologists, etc., with regard to evidence on this point. With the exception of the two cases mentioned below, no evidence was forthcoming.

The two letters giving information of a positive character were from Dr. Wm. G. Smith, of the East of Scotland College of Agriculture, and Mr. S. P. Mercer, Acting Adviser in Agricultural Botany at Armstrong College, Newcastle-on-Tyne. Dr. W. G. Smith stated that a Smut fungus had occurred in young leeks and onions (especially the former) in some allotments near Edinburgh in 1912. The fungus was not, however, determined with certainty, and no record was published. The disease had not been observed before that date and no fresh cases had occurred. Dr. Smith kindly forwarded specimens preserved in spirit and the fungus proved to be the true Onion Smut *U. cepulae*.

Mr. S. P. Mercer in a detailed report showed that the disease was present in several gardens in Northumberland. He pointed out that it had been observed in 1914 and that its occurrence was noted in the Report of the Adviser in Agricultural Botany (Mr. W. B. Mercer) for 1914-15, but this report was not published. Being listed in the volume by Massee, cited above, the disease was not regarded as new to Britain. Leeks were stated to have been the first attacked and these have always shown greater susceptibility than onions. In 1918 Smut appeared in several new gardens in widely separated localities. An examination of the garden infected in 1914 failed to reveal the presence of Smut, but it should be noted that the examination was made late in the season, when attacked plants, had there been any, would probably have died and disappeared. Mr. Mercer had all the cases under strict observation and has in hand a number of trials with soil fungicides.

Further inquiries and careful observations were continued during the remainder of the season, as far as possible throughout the whole country, but no further outbreaks were reported.

Since it had been demonstrated in America that onion seed was at times liable to be contaminated with Smut spores (Ann. Report, Mass. Agric. Expt. Sta., 1910, pp. 164-7), it appeared possible that Smut was being introduced into this country with foreign seed. Fifty-two samples of American seed which was about to be sown at Kew were therefore tested for the presence of spores. Although in several cases resting spores of Onion Mildew were found, no evidence that the samples were contaminated with Smut was obtained.

Description of the Disease.—In the early stages of attack Onion Smut shows itself as dark opaque spots or streaks on the leaves. The streaks are at first covered by the skin of the leaf, but this is soon ruptured by the fungus within, and a sooty, powdery mass of spores is exposed. The spore-mass readily falls out or is blown away. In Figure 1 a mass of spores, still *in situ*, is seen in the upper part of the outer leaf on the left. This spore-mass formerly extended to the base of the bulb, but in the lower part it has almost entirely fallen away. It is from the presence of the soft, sooty mass of spores that the group of Smut fungi receive their name. Spore-masses form in the inner as well as in the outer leaves, and the outer scales of the bulb itself may also be affected in the same way.

The spores fall from the plants and contaminate the soil. Thaxter has estimated that a smutted onion plant, if of large size, may produce between one and two million spores. Examined with the microscope, the spores are of the compound type usually termed "spore-balls," and characteristic of the genus *Urocystis*. They consist of one, or rarely two, large dark spores (12-16 μ diam.) surrounded by a number of small, paler, sterile cells. The entire spore-balls measure 17-24 μ in diameter.

Onion Smut attacks seedling onions whether sown in spring or autumn. Its effect on the plant varies considerably. In bad cases the seedlings are killed outright, but in milder attacks they survive, though they are often severely crippled. White onions, especially White Lisbon, appear to suffer most. With regard to weather, favourable growing conditions, especially during the critical period of infection, probably assist the plant in overcoming the attack. In a hot, dry season, when the vigour of the host plant is reduced, the disease is more fatal.

Method of Infection.—Although the disease first shows itself externally in the form of dark areas on the leaves, the fungus

entered the plant much earlier in its career. It was shown by Thaxter that the plants are only attacked when quite young. Actual infection takes place below the ground level, and is probably confined to the first leaf. The mycelium produced develops within the tissues of the seedling, spreading upwards, and subsequently invading other leaves and producing the spore-masses described above. It will be observed, therefore, that the method of infection in Onion Smut, though comparable to that occurring in certain other Smut fungi, is different from that found in most leaf diseases (*e.g.*, mildews and rusts). The spores are unable to infect the green leaves above ground. It is particularly fortunate that this subterranean infection is confined to quite young seedlings, since it enables "sets" and seedlings raised in clean soil to be planted on contaminated land without fear of their contracting the disease.

Spread of the Disease and Vitality of Spores.—Onion Smut is distributed by any means which conveys the spores from one area to another. The bulk of the spore-mass falls to the ground on which the crop is grown, but, as the spores are very light, a certain number may be distributed by wind, though being produced so near the soil level they are probably not blown very great distances. Insects also may carry the spores. Flea Beetles were observed by Thaxter as swarming over the diseased leaves and apparently feeding on the spores, and these beetles are well known to travel long distances in search of food. In addition to the natural agencies mentioned, the disease may be spread by tools and implements, and also by the feet of workers conveying contaminated soil from one area to another. These means of distribution, being controllable, should be carefully avoided.

Although the fungus does not penetrate the seed and is thus not conveyed *in* it as is the case with some Smut fungi, it is quite possible for seed to become mixed with spores if grown in districts where Smut is plentiful. It is probable that the European outbreaks are directly or indirectly attributable to the use of such contaminated seed.

In common with many soil fungi, the spores of Onion Smut may retain their vitality for many years. It was formerly thought that a 5-year rotation would be sufficient to starve out the disease, but this proved quite erroneous. Thaxter mentions a case, apparently well authenticated, where bad outbreaks occurred in a field after twelve years, and it is probable that the spores may remain alive for a much longer period.



FIG. 1.—PLANTS AFFECTED WITH ONION SMUT.

Left: Showing an open fissure in the outer leaf of the bulb from which the bulk of the black spore mass has fallen out. A portion of the mass of spores is seen opposite S.

Right: A more severely diseased and crippled plant.

Control.—1. *Prevention of Spread.*—To prevent distribution of the spores and further contamination of the soil, it is absolutely essential to pay strict attention to the following points :—

(a) All diseased plants should be carefully dug up and destroyed by fire. This should be done as soon as the black streaks indicating the presence of the fungus and the formation of spores are visible, and before the spores are discharged. On no account should diseased plants be consigned to the rubbish or manure heap or allowed to decay on the ground.

(b) It is of the utmost importance also that the soil on which the smutted crop was produced, and all soil known to be contaminated with spores, should be confined to its present area, and not allowed to be carried to other beds or other gardens. Wind and rain may hinder this to a certain extent, but if the boots of those working on infected soil are properly brushed, and all tools carefully cleaned, the risk of spread will be reduced to a minimum.

2. *Suspension of Onion and Leek Growing on Affected Land.*—In view of American experience it is folly to attempt to starve out the disease by means of ordinary rotations. The case of a bad outbreak in Connecticut after a lapse of twelve years is apparently well authenticated, and one of the latest American text-books (Hall and Stevens, 1913) states that there is no record of soil once smutted having become clean. Sowing onions on affected land must, therefore, be discontinued. Leeks are if anything more susceptible to Smut than onions, so that the cultivation of this crop, and, for the sake of precaution, of shallots also, should be confined to soil free from contamination.

3. *Transplanting and the Use of "Sets."*—Although it is impossible to raise clean seedlings on contaminated soil it has been proved that seedlings raised in clean soil may be transplanted to land infested with spores without fear of their becoming infected. The fungus can only enter the plants whilst they are very young, and when once this stage is passed they may be transplanted to any soil with safety. For the same reason onion "sets" may be used. With regard to leeks, there is at present no definite evidence on this point, and until tests have been made it will be wise not to transplant leeks to affected ground.

It will be observed that the above system of cultivation forms an exception to the general rule enunciated under "2." In the case of Britain, however, the amount of contaminated

land is so small that it is hardly necessary to resort to the transplanting method, especially since it possesses an element of risk in that ungerminated seed or very young seedlings, still liable to attack, are apt to be accidentally carried with the older seedlings.

4. *Fungicides*.—The use of fungicides is resorted to in America when it is necessary to sow onions on land known to be affected, and the treatment has been successful in reducing the amount of disease. In the early days lime and sulphur were much recommended, but more recently formaldehyde has been advocated. In both cases the fungicide is applied to the drills. Various strengths are employed, but as no substance has been discovered which secures complete immunity to the disease, and as in this country there is no necessity to sow seed on affected land, details need not be given here.

IN connection with the work conducted at the Pathological Laboratory, Kew Gardens, it was decided last year to separate the Board's administrative and advisory work from research. There was consequently a tendency in 1918 for workers to confine themselves to one or other aspect of the work, though at the same time the advantages to be gained from the blending of the research and applied aspects of pathology prevented this from being exclusively the case.

**Work on Plant
Diseases at the
Royal Botanic
Gardens, Kew.***

With regard to the administrative side a special attempt was made to develop the Intelligence Service inaugurated last year and to obtain an idea of the plant disease situation in the country as a whole. On the research side work on problems of general importance was continued, and investigation carried out on the biology of several important parasitic fungi. As in previous years the routine duties of the laboratory interfered with experiments and research, but on the whole the various branches of pathological work were carried out successfully.

The Board's entomological staff have also worked in the same building, and throughout the year the closest co-operation has been maintained between the workers in these two branches of plant-pathology.

On 18th November Mr. A. D. Cotton and Mrs. N. L. Alcock were transferred to the staff of the Board of Agriculture, the former becoming Mycologist to the Board.

* This Note is abridged from an account given in *The Kew Bulletin of Miscellaneous Information*, Nos. 1 and 2, 1919.

The Plant Disease Survey (including both animal and fungus pests) was instituted last year by the Plant Disease Sub-Committee of the Food Production Department. By means of a system of monthly reports, prepared by specially qualified honorary correspondents in all parts of the country, a very large amount of information was gathered. Further data were acquired by means of visits, circular letters, and special inquiries. In this way it has been possible to obtain a more accurate and detailed idea than has ever been obtained before of the incidence of disease in the country.

Diseases.—With regard to noteworthy fungus diseases in the year 1918, the following may be mentioned:—

A rather bad attack of Yellow Rust of Wheat (*Puccinia glumarum*) occurred throughout a very large part of the country during the early part of the season. This was in striking contrast to the previous year, when Yellow Rust was practically absent. In the eastern counties especially the attack was severe, and even resistant varieties such as "Little Joss" suffered to some extent. Much of the wheat, however, outgrew the disease as the season advanced, but in many cases the plants suffered considerably. An attempt was made to determine the susceptibility of the different varieties in different localities.

Wheat Mildew was also prevalent in certain districts in July and August, especially where nitrogenous manures, such as sulphate of ammonia, had been freely applied.

Fruit suffered perhaps less from fungus diseases than usual. The distribution of American Gooseberry Mildew, which in 1917 was extremely limited, increased materially, and, as was to be expected, radiated out from the centres where it had occurred that year.

Another contrast was found in the case of Black Currant Rust (*Cronartium ribicola*), the general occurrence and abundance of which, in 1917, was phenomenal. In 1918 the rust, except when in immediate proximity to diseased Weymouth pine (its alternate host), was absent. In autumn the disease spread somewhat in a few localities, but probably in all cases starting from the infected pine centres.

With regard to vegetables, during spring damping-off of seedling tomatoes through *Phytophthora cryptogea* caused still further damage. Sterilisation of soil and the use of non-contaminated water have proved successful as control-measures. A leaf-blotch in cucumber, due to *Colletotrichum oligochaetum*, was estimated to cause a loss of several thousand pounds in

Hertfordshire, in which county also Sleeping Disease of Tomatoes is still very prevalent, destroying many thousands of plants.

Onions received special attention. The Sclerotium disease, which has been under research for more than a year, proved very destructive last season, and was discovered to exist in practically all parts of England. It was observed at Kew to attack shallots, which hitherto were regarded as being immune (see under "Research," p. 177). Another serious and new disease, viz., Onion Smut (*Urocystis cepulac*),* occurred in two districts (Northamptonshire and Northumberland). This fungus is the cause of much damage in the United States; it occurs also on the continent of Europe. Although no published record of the presence of Onion Smut in Britain exists it was ascertained that the disease appeared near Edinburgh seven years ago, but has not been observed since. The fungus has again established itself in Britain (probably being reintroduced with the seed), and every effort is being made to exterminate it.

Advisory Work.—Advisory work covered a large range of diseases and was particularly heavy in late spring and early summer. Owing to all questions relating to potato diseases being dealt with by the Food Production Department, the laboratory was relieved of at least 500 inquiries with regard to this crop. The number of inquiries dealt with was 730. Although most of these were answered by means of correspondence, in several cases visits were paid with profitable results. Some fifty visits to all parts of the country were paid during the course of the season. Some of the more important cases were Yellow Rust in Wheat, Failure of Oats, Barley Stripe, Wart Disease of Potato, Potato Blackleg, Apple Mildew, Apple Canker, Weymouth Pine Blister Rust, Sclerotium Disease of Onion, and the newly-introduced Onion Smut.

Special visits were paid to a large number of orchards in the West of England in connection with the extensive damage caused by Silver Leaf.† The method of infection, effect of soil-conditions, and especially the question of stocks, were studied in the field. All the most recent researches, both in the orchard and in the laboratory, tend to confirm the view that the disease in the vast majority of cases is caused by *Stereum purpureum*, which gains entrance to the tree through wounds.

Technical advice has also been supplied to the Horticultural, Technical, and Supplies Divisions of the Food Production

* See also article on p. 168.

† " " " " p. 162.

Department, and also to the Seed Testing Station of the Board of Agriculture and Fisheries with regard to various fungi affecting particularly seed wheat. Some sixty samples of the latter have been received for investigation.

Research.—The investigation of *Botrytis cinerea* was continued. The life-history of the Rose Blotch fungus was investigated, and a new method of hibernation similar to that which occurs in Apple and Pear Scab was discovered.

Research on the biology of the onion Sclerotium disease was continued. The name *Sclerotinia bulborum*, under which the disease has recently passed, was found to be incorrect, the fungus in reality being *Sclerotium cepivorum*, Berkeley. The parasite was shown to attack the plant by means of the roots and to spread upwards to the base of the bulb. It forms both spores and sclerotia on the bulbs in the soil, and although it has been grown for fifteen months in pure culture, no signs of an ascigerous stage (the spores of which would, under natural conditions, presumably be air-borne) has developed. Garden sanitation, rotation of crops, and the use of soil fungicides, are therefore required for its control.

The investigation on Skin Spot of the potato was continued. The fungus was isolated and shown to be quite distinct from *Spicaria*, Solani. From reports received through the Plant Disease Survey the disease was found to develop very widely during the winter of 1917-18 on many varieties, and is apparently increasing in abundance. The fungus, however, does not succeed in reaching the inner part of the tuber, being restricted to the surface layers.

The Experimental Ground.—A further portion of the ground was laid out in 1918 and replanted with young fruit trees. A large part was again kept under potatoes, and a variety of vegetables was grown for experimental purposes. A 10-rod "allotment plot" was marked out and planted in order to obtain exact figures of the yield, in connection with statistics for the allotment movement.

In addition to the work on fungus diseases, a portion of the ground was used by the entomological staff of the Board of Agriculture for Frit Fly experiments, and for the testing of insecticides on various fruit trees.

Of the fungus diseases, mention may be made of the following :—

With a view to testing the theory of hibernating mycelium in the case of Black Currant Rust, 200 young bushes of black

currant, very badly affected with *Cronartium ribicola*, were purchased in the early autumn of 1917. The growth made by these bushes in the spring was clean and showed no signs of any rust pustules, and microscopic examination of the buds and twigs, carried out in the laboratory in winter, failed to reveal any trace of mycelium.

Plans had also been made to test the value of spraying mixtures for controlling Black Currant Rust. Spraying experiments were therefore arranged to be carried out on plots in a plantation near Norwich, which was very badly attacked last summer, as well as at Kew. By arrangement with other workers, 1 per cent. Burgundy mixture was selected as a fungicide, Bordeaux mixture and lime sulphur being tested elsewhere. The first spraying was given on the Norwich plots on 13th June, a week or so previous to the time at which an outbreak might be expected. The results of the experiments were, however, negative, since, as mentioned above, there was practically no outbreak of *Cronartium* last season and all the plots remained clean. It was, however, ascertained that 1 per cent. Burgundy mixture caused no leaf injury.

Several plots were used for experimental work on the research carried out on Skin Spot of the potato. Trials also of seed-tubers affected with Sprain and *Verticillium* were also conducted. The spontaneous outbreak of a considerable quantity of the last-named disease in various parts of the ground provided copious material for the commencement of research.

Extensive preparations were made for work on onion diseases, especially *Sclerotium cepivorum*, but no general and uniform infection could be brought about. Observations were therefore made in a neighbouring market-garden, where the disease was abundant.

A spontaneous outbreak of Yellow Rust (*Puccinia glumarum*) on wheat sown for Frit Fly experiments is worthy of record.

Fertilisers as a Means of Counteracting the Bad Effects of a Late Season.—There are two groups of fertilisers that help to counter-

**Notes on Manures
for June :**

*From the Rothamsted
Experimental Station.*

act the bad effects of a late season such as the present—nitrogenous and phosphatic fertilisers. Nitrogenous manures cause the plant to push ahead more quickly in spite of the coldness of the soil, and thus to attain a more rapid rate of growth and development. For cereals in late spring, for cabbage, and, at this late period of the year for mangolds and grass also, the best nitrogenous fertilisers to use are nitrate of soda, nitrate of ammonia or nitrate of lime, but for swedes, turnips, rape and potatoes, a wider choice is possible, and sulphate of ammonia may be used instead if it is more convenient.

Phosphates are of value in a late season by hastening root development in the early days of plant growth, and hastening the ripening process later on. After the recent cold, wet and snowy weather it will be desirable to inspect the crops and see whether help is needed and is still possible to secure an earlier start and earlier harvest.

Calcium and Ammonium Nitrate as Fertilisers.—Although farmers are quite accustomed to nitrate of soda, and understand its use as a fertiliser, they are not so familiar with two other nitrates now available, viz., calcium nitrate, also known as nitrate of lime, and ammonium nitrate. Both are of considerable value and may be used in all cases where nitrate of soda is known to be effective. They must be compared on the basis of their nitrogen content :—

Nitrate of soda contains	15½	per cent.	of nitrogen.
„ „ lime „	12	„	„
„ „ ammonia,,	34	„	„

Thus nitrate of ammonia is the most concentrated of the three, and is required in less than half the amount needed of the others; at the present moment it is the cheapest, but it is hardly likely to retain this position for long. Both nitrate of ammonia and nitrate of lime are supplied in forms in which they can readily be drilled, although a certain amount of care is necessary in storing them, otherwise they are likely to become caked.

Caution as to Worthless Manures.—A correspondent has forwarded a circular sent out by a certain firm—not one of the recognised manure manufacturers—offering as fertiliser a material described as a complete mineral plant food at the price

of £10 per ton. Analysis showed that the material contained no nitrogen, no phosphate, and only a small amount of potash ; there was, however, a little calcium carbonate, but the bulk was inert mineral material. Farmers and allotment holders cannot be cautioned too strongly against specious advertisements claiming unusual powers for particular proprietary articles. A large number of experiments have been made by fully qualified and disinterested persons in many parts of the country and with many crops and substances, and **no authentic record exists to show that any substances are of use as fertiliser to farmers in this country except compounds of nitrogen, phosphorus, potassium, certain compounds of calcium (i.e. lime, limestone, and gypsum,) and sodium (salt, and sodium sulphate).** Most of these substances are worth buying. A few experiments indicate that magnesium compounds may, under certain circumstances, be of some use, though not very much ; in Italy manganese compounds have been supposed to be of value, though British experiments have not supported this view ; while iron compounds have also been considered as fertilisers. Neither magnesium, iron, nor manganese compounds, however, are worth paying for, as their action is far too uncertain to justify expenditure by any except the most adventurous of experimentally-minded growers. As to other substances there is still less indication that they ever possess value. Before paying for any fertiliser farmers should demand the proper invoice and should see that they are really obtaining full value for their money.

Magnesian Lime : Is it harmful ?—Correspondents have recently asked whether magnesian lime is safe to use. The subject was dealt with in this *Journal* for December, 1918 ; it was investigated by Mr. J. A. Hanley in Yorkshire, who found* that magnesian lime can well be used on heavy soils, but may cause trouble if applied to light land.

Sewage Sludge as Fertiliser.—Considerable attention is now being paid to the possibility of obtaining fertilising material from sewage. Numerous experiments have been made in the past to ascertain the manurial value of the sludge collected in settling tanks, but the results have not been very satisfactory. The usual course of events is that farmers are first induced to purchase it, but finally have to be paid to take it away. Methods have, therefore, been devised for improving the sludge, perhaps the commonest being to add a certain proportion of lime and then to force the mass into presses when it forms a

* *Journ. Soc. Chem. Industry*, 1918, Vol. 37, pp. 185-190.

cake containing roughly 50 per cent. of water, 15 to 25 per cent. of organic matter and 25 to 35 per cent. of mineral matter (much of which is lime); these constituents contain about 1 per cent. each of nitrogen and of phosphoric acid (corresponding to $2\frac{1}{4}$ per cent. of phosphate). Several of these pressed sludges were tested on field crops during the years 1905-8, but the results were not good; only in the wetter districts of the North of England did they seem to have much value.* In some places, *e.g.*, Glasgow, Kingston, etc., other materials are added to enrich the sludge, and this method can, of course, be made to yield a fertiliser of any desired composition.

Since the older work was done other types of sewage sludge have been prepared which yield a richer product than that given by the ordinary methods. Of those already obtained in quantity the best that has come to the writer's notice is prepared by the Huddersfield Corporation at their Sewage Works at Deighton, under Mr. Garner's direction. The sludge is precipitated with acid, which obviates some of the loss incidental to the lime treatment; it is then pressed, treated with benzene to remove grease, and finally dried and ground, when it falls into an excellent condition for drilling. It contains $3\frac{1}{2}$ per cent. of nitrogen, and is thus considerably richer than the ordinary sludge; part of the nitrogen arises from wool fibres—Huddersfield being an important centre of the wool-washing industry. The material is offered at 30s. per ton in bulk.

Another good sewage sludge is sent out from Bradford Sewage Works, where it is made under Mr. Garfield's direction. The process is slightly different from that used at Huddersfield, in that hot pressing instead of solvent extraction is adopted to remove the grease; the resulting material is in good condition and contains 2 per cent. of nitrogen; it is thus twice as good as ordinary sludge. It is sold at 11s. 6d. per ton. Like the Huddersfield sludge it must be considered good value for the money.

It is very desirable that Local Authorities should seriously study the possibility of making fertiliser from sewage sludge. The methods adopted in many places are costly and do not yield a product that can be recommended to the farmer; the experience of Huddersfield and Bradford, however, and trials

* 5th Rept. of the Sewage Commission, 8th Appendix, Cd. 4286, 1908.
A summary was given in this *Journal*, 1908, XV., p. 690.

being made elsewhere, show that the problem of giving the farmer a useful material is not insoluble.

Liquid Manure.—Farmers who are fortunate enough to possess a liquid manure tank can now apply the liquid to the young seeds at the rate of 1,500 gal. per acre, repeating the dose later on if opportunity arises. Those who are proposing to construct a tank can find particulars and designs in a Leaflet issued by the Food Production Department entitled “Liquid Manure Tanks.”*

The Importance of Lime.—In spite of all that has been said and written about lime there are still numbers of fields where lime is badly needed and where nothing at present being done will avail until lime is added. Fresh instances continue to come to light; a recent one is the case of a heavy intractable London clay soil rented at 6s. per acre, which in its unimproved state was liable to be beaten down by rain and made sticky and sodden, but after liming it became friable, is reduced to a good tilth and dries much more readily than adjoining unlimed land. The most rapid improvement has resulted from the application of quicklime at the rate of 3 tons per acre; the cost of this was 30s. per ton. Good results were also obtained from chalk applied at the rate of 15 loads to the acre, and from gas lime also given at the rate of 15 loads per acre; the latter was obtainable at 1s. 10d. per load.

In 1915 the Agricultural Sub-Committee of the Worcestershire Education Committee commenced to carry out a trial, initiated by the Experiments Committee of the Provincial Advisory Council, with different varieties of mangold. Six varieties of mangold were tested, viz.: Golden Globe, Golden Tankard, Red Globe, Red Intermediate, Lion Intermediate, Prizewinner.

**Report on the
Varieties of Mangold
Trials Carried Out
in Worcestershire,
1915-18.**

Samples of the different varieties were analysed annually, and the average composition (of 17 centres) as regards dry matter and sugar is shown in the following table:—

<i>Variety.</i>				<i>Dry Matter.</i> Per cent.	<i>Sugar.</i> Per cent.
Golden Globe .. ..	..	..	..	12.7	7.38
Golden Tankard .. ..	..	..	..	12.18	6.81
Red Globe .. ..	..	..	..	11.14	6.37
Red Intermediate .. ..	..	..	..	10.39	5.74
Lion Intermediate .. ..	..	..	..	10.02	5.54
Prizewinner .. ..	..	..	..	9.76	5.3

The figures for the dry matter show very clearly that different types of mangold vary considerably as regards their composition; in fact, between Golden Globe and Prizewinner there is a difference of nearly 3 per cent. of dry matter in favour of the former. In other words, Golden Globe contained about 87½ per cent. and Prizewinner about 90½ per cent. of water.

The average weight of roots, dry matter and sugar per acre was as follows :—

<i>Variety.</i>	<i>Weight of Crop.</i>		<i>Weight of Dry Matter.</i>	<i>Weight of Sugar.</i>
	Tons	Cwt.	Cwt.	Cwt.
Golden Globe	25	10	65½	38
Golden Tankard	26	5	64	35½
Red Globe	31	16	70½	40½
Red Intermediate	32	15	68	37½
Lion Intermediate	33	14	67½	37½
Prizewinner	32	4	62½	34

The results which have been obtained during the past four seasons and the chief points of interest in connection with the trial are summarised under eight heads, viz. :—

1. The wide differences in the composition of the roots of the several varieties as regards dry matter and sugar.
2. The richness in dry matter of Golden Globe and Golden Tankard and the distinction in this respect between these two and Red Globe, Red Intermediate, Lion Intermediate and Prizewinner regarded as a group.
3. The comparatively small effect which variations in the seasons so far experienced have had as regards modifying the composition of the roots. The dry years have not been conspicuous for producing roots of exceptionally high quality.
4. The fact that the dry matter percentage may rise above or fall below the normal for a given variety when cultivated under different conditions though the relationship in this respect among a number of varieties grown comparatively tends to remain fairly constant.
5. The effect of liberal dressings of active nitrogenous manures in markedly lowering the percentage of dry matter, though they increase the crop considerably.

6. The pronounced difference between the yields of Golden Globe and Golden Tankard as compared with those of the heavier cropping varieties.
7. The marked effect of quality on the production of dry matter and sugar per acre which has enabled Golden Globe and Golden Tankard on much smaller crops to approximate to some of the more robust types.
8. The differences in the physical texture of the roots of the several varieties noticed during sampling. Golden Globe and Golden Tankard being particularly firm, while Lion Intermediate and Prizewinner were much less solid. The physical and analytical characters of varieties are thus closely correlated.

From the point of view of yield per acre of roots and production of food material, it is stated that Red Globe and Red Intermediate have so far in the trial proved the best kinds ; but from the general utility, cropping and quality standpoints, Red Intermediate is the better of the two.

THE attention of the Board has been drawn to a remarkable example of successful working of an allotment. The holder, Mr. J. Croft, of Birkenhead, is employed as a foreman slaughterer, and cultivates his holding in **Profitable Cultivation** his spare time. The area of land under **of an Allotment.** cultivation is only 680 square yards, the soil being a light loam with sandy subsoil.

Mr. Croft is stated to possess a thorough knowledge of allotment cultivation and to be deeply interested in the subject. He attributes his success to the following reasons :—

- (1) Carrying out deep and thorough surface cultivation.
- (2) Careful selection and sowing of seed.
- (3) Transplanting early into nursery beds to secure sturdy plants.
- (4) Quick successional cropping on ~~an~~ intensive system.
- (5) Careful attention to important and necessary details, such as planting, judicious manuring and staking where necessary.
- (6) Constant activity and hard work throughout the whole growing season.

- (7) Growing good quality produce which claims good prices.

All produce is sold on the allotment at the local retail prices, and the demand exceeds the supply almost throughout the year. By successional and intensive cropping a constant rotation is secured and no land is allowed to remain bare more

than a few hours during the growing season. Mr. Croft prefers cow manure when this can be obtained, but it is scarce in the district; he is, however, able to secure a fair quantity of horse manure. All waste leaves are thrown on a heap, and when decomposed are dug in.

A brief indication of the methods adopted in the case of certain vegetables may serve a useful purpose:—

Cauliflower.—Three batches are grown, the first 100 plants being put out in March from a cold frame, which has given them protection through the winter. As these mature their places are filled by other plants brought forward in a nursery bed, and raised from seed sown in a cold frame in March. The third crop is planted out in June, between the rows of autumn onions and shallots. This is the only intercropping practised. Mr. Croft does not think that intercropping with potatoes is economically sound.

Celery.—White and Pink well grown; blanched entirely by paper and planted in shallow trenches. There is always a demand for celery.

Cabbage.—Very few grown (said to be on the ground too long to make a return of 4d. each).

Cabbage Maggot, very prevalent at one time, is said to have been overcome by the use of red lead mixed with water in which the roots are immersed before planting. Nitrate of soda and sulphate of ammonia are used as a stimulant for the cabbage and cauliflowers, and liquid manure made of cow dung and fowl manure is applied when it can be got, the rule being to give several weak applications rather than one strong one.

Onions.—Grown well, planted out from seed boxes, constantly hoed and occasionally stimulated with soot and sulphate of ammonia. Fourteen of the best bulbs weighed 20 lb. and others 1 lb. each.

Lettuce.—This crop sells well and all open spare land is planted up with it. In the summer months the plants are put on the shady side of peas and beans.

Leeks.—Grown well, but eaten in the home.

Brussels Sprouts are given a special piece of ground and planted out early. They are ready to gather at the end of September or early October.

Potatoes.—Great Scot only was grown and lifted early.

Wallflowers are pricked out and sold to a jobbing gardener at 4s. 6d. per 100.

Sweet Peas.—A good profit is made from these, sold at 1s. and 6d. per bunch.

Dwarf Beans.—Each of the plants is staked, otherwise much damage is done to them. A few good plants are selected for seed each year, and every plant of Brassicas is pricked out into a nursery bed; thus good sturdy plants are always available.

In the following table are shown the chief crops grown and

the prices obtained, and remarks are made on the systems of cropping :—

Name of Vegetable.	Quantity.	Prices (Retail).	Remarks.
Artichokes (Jerusalem).	50 plants..	2½d. per lb.	Used as a screen.
Beans, Broad ..	4 rows (2 crops).	3d. to 6d. per lb.	Large demands for broad and dwarf beans, but less for runners till dwarfs had been all sold or reduced in quantity.
„ dwarf ..	220 plants	3d. to 6d. per lb.	
„ runners ..	1 row 26 ft.	3d. to 6d. per lb.	
Broccoli (spring) ..	100 plants	6d. each ..	A ready sale exists for this class of crop, cauliflowers being the best crop planted out in spring from cold frames.
Brussels sprouts ..	120 plants	3d. to 6d. per lb.	
Cauliflower (autumn)	100 plants	6d. to 9d. each.	
Cauliflower (spring sown).	200 plants	„ „	
Cabbage (spring) ..	25 plants..	4d. each ..	Two crops secured from same plot of land ; not largely grown ; " said to be on the ground too long " and then not so readily sold as cauliflower.
„ (summer) ..	50 plants..	4d. each ..	
„ (red) ..	25 plants..	4d. to 6d. each.	
Celery	120 plants	6d. and 7d. per stick.	Blanched by brown paper.
Carrots	—	—	Not largely grown or sold, used mostly in young state.
Leeks	—	—	Grown well but not sold, eaten in own household.
Lettuce (Cos) ..	Continuous crop.	3d. each ..	Always in good demand
Onions (spring) ..	300 plants	5½d. per lb.	Best bulbs, 14 weighed 20 lb. Easily sold.
„ (winter) ..	300 plants	5½d. per lb.	Not a heavy crop ; readily sold.
Shallots	Fair sized bed.	8d per lb.	Heavy yield, but no account of weight kept.
Peas (Gradus) ..	1 row 26 ft.	17s. 6d. profit.	—
Potatoes (Great Scot)	80 sq. yds.	1½d. per lb., 3 cwt. sold.	Lifted early in September, and wallflowers picked out on same ground.
Parsnips	Fairly large bed.	—	Local retail prices secured for these vegetables.
Turnips	—	—	—
Sweet peas	2 rows 26 ft. long.	1s. and 6d. per bunch.	
Wallflowers ..	1,000 ..	4s. 6d. per 100.	Grown for jobbing gardener.

On p. 187 is given the balance-sheet for the year ending 31st December, 1918. The falling off from October onwards is

attributed by Mr. Croft to the fact that he was too busy at his usual work to give the necessary attention to the allotment :—

Balance Sheet Year ending 31st December, 1918.

<i>Expenditure.</i>				<i>Income.</i>			
	£	s.	d.		£	s.	d.
Potatoes	1	15	6	January	1	8	6
Lime		1	0	February	1	0	2½
Pea sticks		3	0	March		14	0
Manure		16	6	April		19	9
Cartage		13	6	May	1	15	10
Rent	1	5	0	June	5	5	9
Soot			6	July	7	1	8½
Plants		7	3	August	10	10	2
Show entry		6	6	September	7	18	4
Cartage		2	6	October	2	11	5½
Seeds		2	0	November	2	5	3
Credit balance ..	43	0	11½	December		15	3
				Prize money ..	6	8	0
	£18	14	2½		£48	14	2½

A REPORT for the year ended 31st March, 1918, dealing with the work of the Departments of Land and Survey, New Zealand, in the settlement of discharged soldiers on the land during the War, and the financial assistance given by way of monetary advances, has been recently issued by that Department. It is stated in the Report that settlement has steadily progressed, from only two soldiers on 1st April, 1916, to 344 soldiers (166,526 acres), on the 1st April, 1917, and 638 soldiers (257,943 acres), on 31st March, 1918, under the provisions of the Discharged Soldiers Settlement Act. In addition to these figures 69 members of the British Expeditionary Force had acquired 138,452 acres of land under the Land Act.

Some very good settlements were opened for selection during the year under review and were offered to the settlers at the cost of acquisition, plus necessary expenses. The tenures under which land may be held are specially suited to meet the needs of the settlers. The rentals payable under the leases represent but a moderate rate of interest on the Government's outlay. The settlers have the right to acquire the freehold either by payment in cash or on deferred payments. This freehold provision does not apply to cases where the land is national endowment or education reserve.

The Government have received various suggestions as to the best kind of land for settlement, but they point out that it is a practical impossibility to settle all soldiers in the same manner. It has been their policy throughout to provide as far as possible land suitable for all classes of applicants, and in accordance with this policy suburban lands suitable for market-gardening, small farms, dairy farms, fruit farms, areas for bee-keeping, pastoral country, unimproved country, and partly improved country have been made available, and the Land Boards, when dealing with applications from returned soldiers, endeavour to settle them on holdings suitable to their experience and training. In settling valuable land it is desirable that as far as possible the settlers should be able to utilise it to the best advantage from the beginning of their tenancy, but in some cases it has been found that their farming qualifications have not been sufficient to enable them to do this, with the result that discontent has been expressed with holdings which in more experienced hands would have provided an ample livelihood.

In the Homebrook Estate, in Canterbury, containing 1,130 acres, the land, after subdivision into 16 farms, was withheld from immediate settlement because of its suitability for training soldiers to farm under a manager. The Report states, however, that the discharged soldiers have shown no inclination to submit to training before taking up land.

Advice has been given to soldier settlers whenever practicable by experts of the Agricultural Department, Crown Lands Rangers, and other officials of the Lands and other Departments of the State, and by private individuals. This advice is of great assistance, and every endeavour will be made to see that all new selectors are given practical advice to enable them to deal with the particular class of land allotted. The purchase of stock is supervised most carefully, so that advances made for this purpose may be expended to the best advantage. In some cases settlers have purchased out of their own funds implements and machinery in excess of their requirements, and it has been pointed out to them that where several small farms adjoin a system of co-operation is advisable wherever possible in the purchase of expensive implements, with a view to avoiding waste of money. This, however, is largely a matter for the settlers themselves, and the Department does not desire to interfere beyond giving practical advice on the subject, but it does not make advances where the requisitions are in excess of what is reasonable for working the sections.

During the year under review 36,677 acres of ordinary Crown land were proclaimed under the Act, as were 25,384 acres of settlement lands and 8,821 acres of national endowment, making a total of 70,882 acres set apart for settlement by discharged soldiers. The setting apart of an area of 14,624 acres was, however, revoked during the year, and, as 337,961 acres had been proclaimed previously, there is a gross total of 394,219 acres which has been made available under the Act. This embraces various classes of lands, which are surveyed and sub-divided into holdings suitable for the maintenance of a settler and his family. The disposal of such lands is a matter for the various Land Boards, who in some cases allot the holdings to individual applicants without competition, or, if a number of applications are received for any particular block, the disposal of the land is usually decided by ballot amongst eligible applicants.

Often local bodies and associations are desirous that the lands in their district should be made available for settlement by the soldiers who served with the Colours from that district. It is pointed out that this is not always advisable, but that the provisions of the Discharged Soldiers Settlement Amendment Act to a large extent meet the case by enabling a soldier who wishes to settle in his own district, or in any desired locality, to obtain an offer of sale from a freeholder, and, if the price is reasonable and the holding is considered suitable for the applicant's requirements, there is power either to assist the settler to obtain the freehold title by the Government advancing the greater part of the purchase-money on first mortgage, or else for the Government to purchase the land under Section 3 of the Amendment Act, 1917, through the Board of Land Purchase Commissioners, and allot it to the applicant.

A case in which sympathy with returned soldiers found practical expression is quoted in the Report, in the action of the settlers located in the vicinity of the Stalker Settlement at Seward Downs, in the Southland Land District. It was necessary that an area of 180 acres, comprising portions of each of the allotted sections, should be ploughed, and the work was taken in hand by the neighbouring settlers, with the result that the whole area was ploughed in less than two days. While ploughing operations were in process it was also decided to make provision for the necessary seed, and upwards of £100 was subscribed for the purpose. In many other settlements the soldiers have received practical assistance and also valuable advice from the local patriotic societies.

The Amendment Act referred to above also extends the powers of the Minister to make advances of money for the purpose of assisting discharged soldiers, and provides for the acquisition by the Crown on behalf of individual discharged soldiers of privately-owned land in cases where such soldiers are not in a sufficiently good financial position themselves to purchase without the assistance of the Crown, and the acquisition of land for soldiers' dwellings, the erection on such land of suitable houses, and the letting of these houses to discharged soldiers on terms somewhat similar to those adopted in the case of what are generally known as workers' dwellings.

Regulations have also been issued under the Amendment Act, under which an amount up to £2,500 may be advanced to a discharged soldier to assist him in acquiring freehold land or land held under lease from a Land Board, the advance with interest at 5 per cent. per annum being repayable by instalments over a period of 36½ years.

THE following notes have been abstracted from the *Agricultural Organisation Society News and Notes* for April, 1919:

**Successful
Co-operative
Societies.**

— **The Upton-on-Severn Branch of the Worcestershire Fruit and Vegetable Society, Ltd.**—This Society has had a very successful year, and with sales amounting to over £10,000 shows a "profit" of £1,355. The number of members in this district was 120 at 31st December, 1918, holding 5,764 shares of 5s. each. The branch has a catering department, and it also contracts with the Ministry of Food for considerable quantities of vegetables for drying purposes. Another department of the work of the branch is preserving. The output of jam alone in this department was close on twelve tons for the year. The Ministry of Food have also undertaken to place in buildings which have been purchased a pulping plant, and to run the plant for the duration of war and six months afterwards.

The Wimborne and District Agricultural Co-operative Society, Ltd.—This society has well maintained the progress made in previous years and is now firmly established. The society's report and balance-sheet for 1918 have now been issued, and show that on 31st December the membership was 535, an increase of 272 during the year. The paid-up capital now amounts to £1,662 and the sales of feeding stuffs, etc., during

the year have amounted to £23,958, on which a "profit" of £1,706 has been realised. Of this sum £703 is being added to reserve, thus increasing the fund to £1,374.

Saffron Walden, Bishop's Stortford and District Farmers' Association, Ltd.—This society has had a record year, the sales having increased by over £36,000 to £91,405. New capital authorised last year has been readily forthcoming, £1,000 beyond requirements being offered. The net "profit" for the year is £1,534 and the reserve fund now amounts to £1,546.

West Midland Farmers' Association, Ltd.—Taking into consideration the difficulties under which the business of this society has been carried on during 1918, the result of the year's trading is satisfactory. Despite a reduction of £31,561 in the amount of sales, due to the great difficulty in obtaining supplies of feeding stuffs during the year, the society realised a net surplus of £2,324. The society has 858 members, an increase of 66 during the year.

THE Select Committee on National Expenditure, Session 1918, recommended that the procedure of the House of Commons with respect to Money Resolutions for Government Bills involving expenditure should be extended, and that such Resolutions should either comprise a statement of the probable expenditure, either capital or annual, or be accompanied by a White Paper furnishing such a statement.

The Committee further recommended that if cases should occur where the conditions did not allow a forecast to be made, the fact should be stated in a White Paper, with a full explanation of the reasons.

It has accordingly been thought desirable to place before Parliament the following Memorandum (Cmd. 132) with regard to the probable expenditure under the Land Settlement (Facilities) Bill.

(i.) **Capital Expenditure.**—The amount of the capital expenditure likely to be incurred under the Bill will depend upon (a) the number of small holdings established, (b) the cost of the land acquired, and (c) the cost of the cottages and buildings erected and of other equipment provided. All these factors are at present unknown, and it is consequently impossible to give any detailed estimate of the probable cost.

Demand for Small Holdings.—Up to the present County Councils and the Councils of County Boroughs have received applications for small holdings from 13,797 applicants, who have asked for an area totalling 247,277 acres. It is known that the proportion of applications received from men still serving overseas is small, and it may be confidently expected that in the course of the next few months these figures will be very considerably increased. It has not been possible to arrange up to the present for any large proportion of the applications to be

investigated, but in those counties in which a considerable number of applicants have been interviewed the percentage rejected as being unsuitable is small.

Cost of Land.—During the seven years 1908–14, in which the Small Holdings and Allotments Act, 1908, was in operation, 14,389 holdings were provided by County Councils and the Councils of County Boroughs in England and Wales. The total area of land acquired was 198,106 acres, of which 139,478 acres were purchased for £4,601,692, the average price being £33 per acre. The average size of the holdings was 14 acres. The average capital cost for land was, therefore, approximately £460 per holding.

The market price of land suitable for small holdings has probably increased by 25–30 per cent. since the outbreak of war. On the other hand, the large demand which is being received from ex-service men for cottage holdings (*i.e.*, for an untied cottage with a piece of land attached, $\frac{1}{2}$ acre to 3 or 5 acres in size) will have the effect of reducing the average size of holdings to be provided under the Bill. It is unlikely, therefore, that the average cost of the land per small holding will exceed the pre-war figure, or, say, £450.

Cost of Equipment.—In the years 1908–14 the number of dwelling-houses provided on small holdings let or sold by County Councils was 2,510, that is to say, 20 per cent. only of the holdings had dwelling-houses upon them. Of these 1,736 were purchased with the land and 774 were new houses erected by the County Councils. In other words, out of the 14,085 small holdings sold or let by County Councils only 6 per cent. had new cottages erected upon them. On the other hand, of the 304 small holdings provided by the Councils of County Boroughs 112 were equipped with new cottages. In view of the great dearth of cottages in rural districts, and of the desirability of settling small holders on the land which they cultivate, it is probable that in the future the County Councils will have to erect dwelling-houses on a much larger proportion of the holdings provided by them. The average capital outlay on equipment in cases in which a cottage, with buildings, fencing, and possibly roads, have to be provided may be as much as from £900–£1,000 per small holding.

Total Capital Expenditure.—Clause 13 (2) specifies the sum of £20,000,000 as applicable by the Public Works Loan Commissioners for loans to County Councils during the next two years for the purposes of capital expenditure. On the basis of the above calculations this sum would provide about 15,000 fully equipped small holdings at present prices of land and buildings. A proportion of the small holdings which will actually be provided will, however, be established on land leased and not purchased by County Councils; in some cases no buildings will have to be provided, and in others it will be necessary only to adapt the dwelling-houses and buildings already existing on the land. The extent to which this takes place will reduce the average capital cost per holding. The £20,000,000 may, therefore, be regarded as sufficient to provide a minimum of 15,000 or a maximum of, possibly, 50,000 holdings, according as the land is purchased or leased, or as the holdings are completely or partially equipped with buildings.*

* In addition, the Board are themselves authorised by the Small Holding Colonies (Amendment) Act, 1918, to acquire up to 60,000 acres in England and Wales for the purpose of providing small holding settlements.

The Public Works Loan Commissioners may lend to County Councils during the next two years any money which the Councils are authorised by the Local Government Board to borrow, not exceeding in the aggregate the amount mentioned. It is difficult to estimate the rate at which loans will be issued, but it is probable that the sum granted during the current financial year will not exceed £5,000,000, in view of the fact that difficulties of labour and material will prevent building on a large scale during this year, and also that vacant possession of a good deal of the land which is now being acquired will not be obtained before Michaelmas next. In 1920-21, however, the issues will probably be considerably larger, and might absorb the whole of the balance of £15,000,000.

In 1921-2 and subsequent years loans for capital expenditure will be available from the Local Loans Fund in accordance with the existing procedure under the principal Act, *vide* Clause 13 (3). It is impossible to estimate the amount which may be required under this Clause. It will depend on the extent of the unsatisfied demand for small holdings existing in 1921, and the then price of land and buildings.

The capital advanced by the Public Works Loan Commissioners will, of course, be ultimately recoverable.

(ii.) **Annual Expenditure.**—The other expenses under the Bill will be met out of the Small Holdings Account, which was established by Section 51 of the Small Holdings and Allotments Act, 1908. This account is fed by Votes from Parliament. The sums expended by the Board of Agriculture under this head in the years preceding the War were as follows:—

<i>Financial Year.</i>	<i>Expenditure.</i>
1911-12	£45,395
1912-13	47,940
1913-14	53,322
1914-15	45,213

Provision has been made in the Estimates of the Board of Agriculture for 1919-20 for a grant of £177,000 in aid of the Small Holdings Account to cover outstanding grants to Councils under the principal Act as well as expenses to be incurred by the Board under the Small Holding Colonies Act and the present Bill.

The principal payments to be made out of the Small Holdings Account under the Bill in future years are:—

(1) The losses incurred up to 31st March, 1919, on the existing schemes of County Councils and County Boroughs under the Bill, *vide* Clause 22 (2). The sum payable under this head should not exceed £50,000, and this payment will replace the payments hitherto made under Sections 6 (4) and 21 of the Act of 1908, and also the payments made under Treasury Minutes towards the expenses incurred by Councils in ascertaining the demand for small holdings. These payments amounted on the average to £32,000 per annum in 1908-14.

(2) The annual deficiencies of County Councils and of Councils of County Boroughs for each of the next seven financial years up to the 31st March, 1926, *vide* Clause 22 (1). The amount payable in 1920-21 under this head may be estimated at £250,000, and in subsequent years it might rise to £400,000. This estimate is based on the assumption that the annual loss on small holdings provided under present conditions, and with loans at 5½ per cent. interest, will be on the average from £2 to £2 10s. per acre.

(3) The loan charges on the proportion of the capital expenditure which will have to be written off after the final valuation in 1926, *vide* Clause 23 (3). It is impossible to estimate the liability under this head, as it depends on the level of values and prices in 1926. If these fall to anything like the pre-war levels, it might be necessary to write off as much as 40 per cent. of the capital expenditure, *i.e.*, £8,000,000. As against this may be set off any appreciation in the value of the land acquired by County Councils before the War.

(4) The expenditure by the Board acting in default of a County Council or the Council of a County Borough, *vide* Clause 3. The expenditure under this head cannot be estimated, as it depends on the extent to which Councils carry out their duties under the B.A. But in any case this Clause does not involve any increase in the total expenditure, as it will merely mean that the Board will defray expenditure which, had it been incurred by Councils, would, in the case of capital expenses, have been met by means of loans borrowed from the £20,000,000, and, in the case of annual expenditure, from the Small Holdings Account under paragraphs (1) and (2) above.

A REPORT (Cd. 114) has been issued by the First Commissioner of Works, showing the results of the special war cultivation of certain areas in the Royal Parks during the year

Report on War 1918. The following is the summary of
Cultivation in Royal profit and loss for each of the parks :—
Parks.

	Profit.			Loss.		
	£	s.	d.	£	s.	d.
Bushey Park	655	5	0*			
Greenwich Park—Nursery Account	11	8	5			
Greenwich Park—Utilisation of						
Vacant Glasshouses	58	16	1			
Hampton Court Park and Gardens	272	12	6			
Hyde Park—Utilisation of Vacant						
Glasshouses	425	2	7			
Kensington Gardens—Model Allot-						
ments	26	12	1			
Queen Victoria Memorial Garden—						
Flower Beds	6	5	3			
Regent's Park—Flower Beds ..	26	18	3			
Regent's Park—Model Allotments	24	7	11			
Regent's Park—Utilisation of Va-						
cant Glasshouses	152	11	2			
Richmond Park	—			130	18	1*
Richmond Park—Nursery Account	69	5	9			
Royal Parks generally—Allotment						
Holders—Seedling Plant Account	39	19	10			
	£1,769	4	10	£130	18	1*
Net Profit				£1,638	6	9

* These items include cereals and straw, the figures relating to the sale of produce for which are approximate only.

Cereals.—In reply to Captain Terrell, the Parliamentary Secretary to the Board stated that the amount of land under cultivation in wheat, barley, and oats in Great Britain and Ireland in 1918 and 1917 was as follows:—

		<i>Great Britain.</i>		<i>Ireland.</i>	
		1918. <i>Acres.</i>	1917. <i>Acres.</i>	1918. <i>Acres.</i>	1917. <i>Acres.</i>
Wheat	..	2,635,723	1,979,416	157,326	124,082
Barley	..	1,653,644	1,618,931	184,712	177,135
Oats	..	4,023,886	3,300,252	1,579,537	1,463,737

He added that there were no available figures at present for 1919, but that he was informed that inquiries made showed that the area under wheat in Great Britain on the 1st April was about 10 per cent. less than last year. (29th April, 1919.)

Live Stock.—In answer to Captain Terrell, the Parliamentary Secretary to the Board stated that it was estimated that the approximate numbers of live stock on farms in England and Wales on the 4th April, this year and last year were as follows:—

		<i>1st April, 1919.</i>		<i>1st April, 1918.</i>	
Cattle	.. ..	5,990,000	.. ..	5,860,000	
Sheep	.. ..	13,650,000	.. ..	13,900,000	
Pigs	.. ..	1,775,000	.. ..	1,530,000	

(29th April, 1919.)

Fertilisers.—In reply to Captain Terrell, the Parliamentary Secretary to the Board stated that the prices of artificial fertilisers had been fixed by Orders issued by the Ministry of Munitions up to the 31st May, 1919. In the cases of sulphate of ammonia and superphosphate the prices fixed were less than the cost of production. Active steps had been taken to increase the quantity available for agriculture, and in consequence this had been larger than in any previous year. It was not proposed to continue the fixing of prices by Order during the coming season, but the Board were endeavouring to arrange by voluntary agreements among the makers that fertilisers shall be sold at reasonable prices. (1st May, 1919.)

Pattrington Farm Settlement.—In reply to Mr. Cautley respecting the Board's Farm Settlement at Pattrington, Commander Eyres-Monsell stated that there are 29 ex-service men working on this Settlement. Thirty-four new houses have been built by the Board. Eleven houses are now occupied by ex-service men, and seven others have been allotted for occupation by ex-service men during the next month.

Under the terms of the profit-sharing scheme, each settler has to serve a probationary period of one year before commencing to share in the profits. The profit during the period from April, 1917, to Michalemas, 1918, was about £11,700, after allowing for interest on capital.

He added that only one ex-service man had been employed beyond this term of probation within the period covered by the account. He will be paid a share of the profits, amounting to the sum of £14 2s. 2d., which represents a dividend of £59 12s. per cent. on the wages paid to him subsequent to his term of probation. The labourer referred to worked for 5½ days a week only, and the wages quoted above are those received after deducting 3s. a week as cottage rent. (1st May, 1919.)

OFFICIAL NOTICES AND CIRCULARS.

N.B.—The Orders which may be mentioned in this section of the JOURNAL may usually be obtained at the price of 1d. each from H.M. Stationery Office, Imperial House, Kingsway, London, W.C., 2 and 28, Abingdon Street, London, S.W. 1; 37, Peter Street, Manchester, and 1, St. Andrew's Crescent, Cardiff.

AN Order (No. 427), dated 7th April, 1919, has been issued by the Ministry of Food substituting fresh Schedules of Prices for those contained in the Edible Offals (Maximum Prices) Order, 1918, and revoking the Orders of 20th September and 20th December, amending the Principal Order.

**Order amending
Edible Offals (Maximum
Prices) Order,
1918.**

THE High Commissioner for Canada is advised by the Minister of Agriculture at Ottawa that the issue of permits for the importation into Canada of cattle, sheep, other ruminants, and swine from the United Kingdom has been resumed, provided that the animals do not come from, or pass through, the County of York.

**Importation of Cattle,
Sheep and Pigs into
Canada.**

THE Food Controller, by a General Licence (Order No. 432), dated 8th April, 1918, has authorised that on and after 1st April, 1919, until further notice, the following varieties of cattle feeding stuffs may be purchased, sold, or otherwise dealt with free from the restrictions imposed by the Oils, Oil Cakes and Meals (Requisition) Order, 1917,* the Cattle Feeding Stuffs (Requisition) Order, 1918,† and the Cattle Feeding Stuffs (Maximum Prices) Order, 1918.‡

**Removal of
Restrictions on certain
Cattle Feeding
Stuffs.**

Home Manufactured Cakes and Meals.—Uncorticated ground nut cake, semi-decorticated ground nut cake, decorticated ground nut cake, palm kernel cake, rape cake, copra cake, sesame cake, soya cake, extracted palm kernel meal, extracted rape meal, extracted soya meal.

Imported Cakes and Meals.—Copra cake, palm kernel cake, Rangoon rice meal, Italian rice meal, Canadian rice meal, Egyptian rice meal, gluten feed, maize meal cake.

Compound cakes and meals (made from two or more ingredients when no oil is expressed in the process of manufacture).

Cakes and meals containing not less than 7 per cent. oil and not less than 20 per cent. albuminoids.

Cakes and meals containing not less than 6 per cent. oil and not less than 20 per cent. albuminoids.

Cakes and meals containing not less than 6 per cent. oil and not less than 17 per cent. albuminoids.

THE Food Controller, by an Order (No. 396), dated 1st April, 1919, amending the Potatoes (Consolidation) Order No. 2, 1918, as amended, has substituted the following Schedule for Schedule IV. of the Principal Order.§

**Order amending the
Potatoes (Consolidation)
Order No. 2,
1918.**

* See this *Journal*, December, 1917, p. 1046.

† " " " February, 1918, p. 1308.

‡ " " " March, 1918, p. 1474.

§ " " " December, 1918, p. 1116, and January, 1919, pp. 1233 and 1237.

Schedule of Scale of Maximum Retail Prices.

Retailers' Cost per Cwt. (See note 1, p. 198.)	Highest Authorised Retail Selling Price over the Counter.			
	Rate per Cwt. for Lots of 1 cwt. or more.	Rate per Stone for Lots of 14 lb. or more but less than 1 cwt.	Rate per Half-stone for Lots of 7 lb. and more, but less than 14 lb.	Rate per Lb. for Lots of less than 7 lb.
1. Any price up to 6s. 3d.	s. d. 7 2	s. d. 1 0	s. d. 0 6	d.
2. Exceeding 6s. 3d., but not exceeding 6s. 7d.	7 6	1 0½	} 0 6½	} 1
3. Exceeding 6s. 7d., but not exceeding 6s. 11d.	7 10	1 1		
4. Exceeding 6s. 11d., but not exceeding 7s. 2d.	8 1	1 1½	} 0 7	}
5. Exceeding 7s. 2d., but not exceeding 7s. 6d.	8 5	1 2		
6. Exceeding 7s. 6d., but not exceeding 7s. 10d.	8 9	1 2½	} 0 7½	}
7. Exceeding 7s. 10d., but not exceeding 8s. 1d.	9 0	1 3		
8. Exceeding 8s. 1d., but not exceeding 8s. 5d.	9 4	1 3½	} 0 8	} 1½
9. Exceeding 8s. 5d., but not exceeding 8s. 8d.	9 7	1 4		
10. Exceeding 8s. 8d., but not exceeding 9s. ..	9 11	1 4½	} 0 8½	}
11. Exceeding 9s., but not exceeding 9s. 4d. ..	10 3	1 5		
12. Exceeding 9s. 4d., but not exceeding 9s. 8d.	10 7	1 5½	} 0 9	}
13. Exceeding 9s. 8d., but not exceeding 10s. ..	10 11	1 6		
14. Exceeding 10s., but not exceeding 10s. 3d. ..	11 2	1 6½	} 0 9½	} 1½
15. Exceeding 10s. 3d., but not exceeding 10s. 7d.	11 6	1 7		
16. Exceeding 10s. 7d., but not exceeding 10s. 11d.	11 10	1 7½	} 0 10	}
17. Exceeding 10s. 11d., but not exceeding 11s. 2d.	12 1	1 8		
18. Exceeding 11s. 2d., but not exceeding 11s. 5d.	12 4	1 8½	} 0 10½	}
19. Exceeding 11s. 5d., but not exceeding 11s. 8d.	12 7	1 9		
20. Exceeding 11s. 8d., but not exceeding 11s. 11d.	12 10	1 9½	} 0 11	}
21. Exceeding 11s. 11d., but not exceeding 12s. 2d.	13 2	1 10		
21. Exceeding 12s. 2d., but not exceeding 12s. 6d.	13 6	1 10½	} 0 11½	} 1½
23. Exceeding 12s. 6d., but not exceeding 12s. 9d.	13 9	1 11		
24. Exceeding 12s. 9d., but not exceeding 13s. ..	14 0	1 11½	} 1 0	}
25. Exceeding 13s., but not exceeding 13s. 4d.	14 4	2 0		
26. Exceeding 13s. 4d., but not exceeding 13s. 7d.	14 7	2 0½	} 1 0½	}
27. Exceeding 13s. 7d., but not exceeding 13s. 10d.	14 10	2 1		
28. Exceeding 13s. 10d., but not exceeding 14s. 1d.	15 1	2 1½	} 1 1	} 2
29. Exceeding 14s. 1d. ..	15 5	2 2		

Notes.—1. The cost to the retailer for the purpose of the above Schedule includes the following items and no more :—

- (a) the actual price paid for the potatoes by the retail dealer ;
- (b) any sums actually paid or payable by the retail dealer for the carriage of the potatoes ;
- (c) where the potatoes are carted by the retail dealer to his premises, a reasonable sum, not exceeding 5s. per ton, in respect of such cartage.

2. In cases where potatoes are bought by the retailer ; bags included, a sum of 6d. per cwt. must be deducted from the actual cost, in order to arrive at the cost for the purposes of the Schedule. For example, if the cost to the retailer of potatoes is 9s. 8d. per cwt., bags included, the selling price is determined by line 11 of the Schedule and not line 12.

3. Where potatoes are sold in lots of 1 cwt. or more, the retailer may charge a deposit of 1s. per bag in addition to the scheduled price.

THE maximum prices of milk for the summer have now been announced. The maximum prices per imperial gallon for wholesale sales by producers in all counties of England and Wales, except Cornwall, Devon, Somerset, and Dorset, and the industrial area of the West Riding of Yorkshire, are to be as follows :—

<i>May.</i>	<i>June.</i>	<i>July.</i>	<i>August.</i>	<i>September.</i>
<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
1 4 ..	1 3 ..	1 6 ..	1 8 ..	1 10

The maximum producer's prices are 2d. less for the counties of Cornwall, Devon, Somerset, and Dorset, and 2d. higher for the industrial area of the West Riding of Yorkshire.

These prices are for cooled milk, despatched twice daily by the producer to the buyer's premises or railway station. The railway charges, if any, between seller and buyer are to be borne by the buyer. The prices are reduced $\frac{1}{2}$ d. per gallon when delivery is made otherwise, and by 1d. per gallon when the milk is collected by the buyer at the producer's premises. Wholesale dealers other than producers are allowed a maximum margin of 2d. per gallon over the producer's price for milk delivered to the buyer's railway station ; and a maximum average margin of 5d. for milk delivered to the buyer's premises.

The maximum retail prices, which are subject to variation by or on behalf of the Food Controller in any food control committee district, or group of such districts, are as follows :—

<i>May.</i>	<i>June.</i>	<i>July.</i>	<i>August.</i>	<i>September.</i>
<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
2 4 ..	2 4 ..	2 8 ..	2 8 ..	3 0

The general retail price in England and Wales is, therefore, 7d. a quart in May and June, rising to 8d. a quart in July and August, and to 9d. a quart in September.

THE object of the Board's scheme for establishing co-operative milk depots is to increase the amount of milk sent into the towns and especially to develop milk production and its marketing on co-operative lines in areas from which the supplies in the past have not been so large as they might have been.

The scheme was brought into operation about the middle of 1918,

and a report which has recently been prepared shows that the progress made up to the end of the year was very encouraging.

The report deals with eight districts, viz., West Wales (3 depots), Bridgwater, Gwinear Road, Dinmore, Llangeoview, Barthomley, Camelford and Erfronydd. In May, 1918, the ten depots in these areas had only 96 members and dealt with only 1,300 gal. of milk daily. In three months' time the members had increased to 299 and the milk dealt with to 7,500 gal. per day. By 16th November, the number of members was 503 and the quantity of milk received at the depots still upwards of 68,000 gal. daily, a very satisfactory total for the time of the year. These increases are all the more significant when it is realised that almost the whole of the milk received at the depots was from new sources of supply, and that it has been very largely delivered to town consumers who would otherwise have gone short by that amount.

Another point of great importance is the effect which the opening of these depots had on the members in the areas in question. In one of the districts the number of cows kept increased by 25 per cent. ; in the second district by 45 per cent. ; in a third by 50 per cent.

The increased production of milk was especially marked in the area covered by the West Wales farmers and in the Bridgwater district, but all the other areas covered by the report show satisfactory progress.

The results obtained in these districts clearly show that the introduction of co-operative depots on similar lines in many other districts where the dairying is relatively undeveloped would provide an additional source of income to the producers and at the same time have a very beneficial effect in improving the milk supplies of the population.

THE following Circular Letter was addressed to Local Authorities by the Board on 15th April :—

**Rabies Order
of 1919.**

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to inform you that it has been found desirable to amend the regulations relating to Rabies and suspected Rabies in animals, and consequently the Board have issued an Order, entitled the Rabies Order of 1919, which revokes and replaces the Rabies Order of 1897 as from the 1st proximo.

The new Order differs from the existing Order mainly as follows :—

1. *Report of Inspector of Local Authority.*—An Inspector of a Local Authority dealing with a suspected case of Rabies has forthwith to make a report to the Board in the form of the specimen attached.* [Art. 2 (2.)]
2. *Compulsory Slaughter by Local Authority.*—A Local Authority is required to slaughter every cat, as well as dog, that is diseased or which is suspected or is shown to the satisfaction of the Inspector of the Local Authority to have been bitten by a diseased dog or cat. (Art. 3.) The expression "dog" includes any canine animal.
3. *Veterinary Inquiry.*—The provisions as to veterinary inquiry require such inquiry to be made in every case in which a Local Authority receives information of the existence, or the suspected existence, of Rabies in any animal or carcass.

* Not here printed.

It is to be noted that the above requirement is not to interfere with or delay slaughter under Art. 3. A report of the inquiry is to be made in every case in the form of the specimen attached.* [Art. 5 (1.)]

If at the time of death the animal is affected with, or suspected of Rabies, a post-mortem examination is to be made by the Veterinary Inspector, who, unless he is satisfied that Rabies did not exist, is at once to forward to the Board material as directed in the Veterinary Report Form which is attached.* [Art. 5 (2.)]

4. *Isolation of Dog, Cat, or other Animal.*—The Local Authority is required to secure as far as practicable the isolation of any dog, cat, or other animal which has been exposed to the infection of Rabies by causing Notices to be served. Copies of all Notices served are to be sent to the Board, the Local Authority and the police. (Arts. 6 and 7.)

It will be observed that there are three classes of Isolation Notice,* namely, Form A.1, to be used in a case of a dog or cat, Form A.2, to be used in the case of a ruminating animal or pig, and Form A.3, to be used in the case of a horse, ass, or mule.

As regards the isolation of a dog or cat under a Notice Form A.1, the object of the Board is to secure detention on suitable veterinary premises in the immediate neighbourhood of the place where the dog or cat is, and failing that, detention on other premises. The place of detention should comprise a kennel or other enclosure with an adjoining space which should provide for the full liberty of the animal in the open air, the whole so enclosed as to prevent any risk of escape of the animal therefrom, or its contact with any other animal, or access of the animal to a human dwelling. The Board realise that there may be cases in which there are available neither veterinary premises nor such facilities as above described on the owner's premises or elsewhere in which satisfactory arrangements could be made. In such a case it would be necessary as a temporary expedient to require the detention of the animal on the premises in the best manner that could be arranged. A special report of the facts of the case should then be made to the Board by the Local Authority in order that further action might be taken thereon by the Board, but this should not be done until every available expedient for securing the detention of the dog on suitable premises has been exhausted. The date entered in (2) of Notice A.1 should be such that the period of detention expires six months after the date of contact.

The isolation of animals, other than a dog or cat under Notice Form A.2 or Form A.3, is to be on the premises on which they are at the time of service of the Notice.

5. *Seizure of Animals in case of Default.*—If an animal is not detained and isolated or is not moved according to the requirements of a Notice served under the Order, an Inspector of the Board may seize the animal. (Art. 8.)

6. *Disinfection.*—The Order contains a requirement as to the disinfection of any enclosure used by a diseased or suspected animal and anything used by or contaminated by the saliva of a diseased or suspected animal before or after death. (Art. 10.)

7. *Forms.*—The forms required for the reports of the Inspector and the Veterinary Inspector of the Local Authority, as well as all the other forms referred to in the Order, have to be provided by the Local Authority.

* Not here printed.

Notification.—The provisions as to notification are altered so as to require that the Inspector of the Local Authority receiving notice from the police of an animal being affected with or suspected of Rabies shall inform the Medical Officer of Health of the Sanitary District, as well as the Local Authority. I am to suggest, however, that the attention of police officers should be specially called to the requirements that the transmission of the information to the Board is to be by telegraph. In this connection I am to state for the information of the Local Authority that a Committee, of which Lord Clinton was Chairman, appointed by the President of the Board to hold an inquiry as to the origin of the outbreaks of rabies in Devon that commenced in September last, came to the conclusion that the disease existed in Plymouth in the middle of May, and stated that, "owing to the freedom of the country from Rabies for a period of 16 years, and a consequent unfamiliarity with the disease and the Regulations concerning it, there has, in our opinion, been a failure on the part of the persons and authorities concerned to realise that Rabies had established a footing in the country and to deal promptly with cases where [in each] their suspicions ought to have been aroused." Including the original case, 123 outbreaks of Rabies have been confirmed in Cornwall and Devon. The disease has also now appeared both in Monmouthshire and in Glamorgan.

Medical Officers of Health to be informed of Persons Bitten.—In the event of it coming to the notice of an officer of the Local Authority that a human being has been bitten by a rabid or suspected dog the Medical Officer of Health should be informed so that he may be in a position to advise as to the person undergoing the Pasteur treatment.

Warning as to Existence of Rabies.—On the existence of Rabies in a locality being confirmed by the Veterinary Officers of the Board, it is desirable that the Local Authority should issue a warning by poster or otherwise.

Publication.—A copy of the Order, together with a Notice, A. 29/A, requiring publication of the Order, is enclosed.*

I am, etc.,

A. D. HALL, *Secretary*.

AN outbreak of Rabies having been confirmed on 16th April in a dog found at New Haw, Weybridge, that had come from Ealing, the Board issued an Order requiring the muzzling of

Outbreaks of Rabies. dogs in the counties of London, Middlesex, and Surrey (except the Godstone petty sessional division) and in parts of Hertfordshire, Buckingham, Berkshire and Hampshire, and controlling movement out of a district comprising the above-named counties and parts of counties. On the following day Rabies was confirmed in an Acton (Middlesex) dog. The Board received confirmation as to a dog destroyed at Gravesend on the 19th ult., which satisfied them that the animal was affected with Rabies, and owing to this and other information the London—Middlesex Control District was on the 7th inst. extended to include West Kent and a part of Essex. An outbreak having been confirmed near Dover the remainder of Kent was made a muzzling and control area.

The total number of outbreaks confirmed is 182, namely, 100 in Devon, 26 in Cornwall, 39 in Glamorgan, 5 in Monmouth, Gloucester 2, Middlesex 3, Surrey 4, London 1 and Kent 2. There are 55 reports of suspected cases still under investigation.

* Not here printed.

THE following Circular Letter was addressed to Local Authorities by the Board on 10th April :—

**Order amending the
Rats Order, 1918,
and the Local
Authorities (Food
Control)
Order (No. 1), 1919.**

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to the above Orders* which have been issued by the Ministry of Food and the Local Government Board amending the Rats Order, 1918,† and the Local Authorities (Food Control) Order (No. 5), 1918,‡ and I am to point out that the powers conferred by the Principal Orders upon a County Council with respect to any Administrative County may, with the consent of such County Council and subject to such restrictions as the County Council may impose, be exercised by the Council of any District or Borough within such Administrative County, or may be delegated by the County Council to the Agricultural Executive Committee for the County, or in the case of the London County Council to the Metropolitan Boroughs. The amending Orders also provide that the expression Local Authority shall include, in addition to County Councils and County Borough Councils, the Mayor, Aldermen and Commons of the City of London in Common Council assembled, or the Port Sanitary Authority of a Port Sanitary District, that is to say of any Port or part of a Port for which a Port Sanitary Authority has been constituted under the Public Health Acts, including the Public Health (London) Act, 1891; that any such Port Sanitary District shall for the purposes of these Orders form no part of any Administrative County or County Borough; and that the City of London shall for the purposes of these Orders form no part of any Administrative County.

I am to say that whilst Lord Ernle has noted with satisfaction the action taken by several Local Authorities, in response to the Board's Circular Letters of the 20th January§ and 25th February last,|| he regrets that many have apparently failed to appreciate the need for any special effort on their part or to recognise that systematic destruction of rats in every district, whether existing in abnormal numbers or not, is a matter of serious national importance. If any substantial measure of success is to be attained it is incumbent upon every Authority to second, by their co-operation, measures taken by the Local Authorities of the Districts which adjoin their territory, and it is equally their duty to give support to the efforts of those private individuals within their District who endeavour to rid their premises of the pest.

Lord Ernle trusts that Local Authorities who have not up to the present acted on the suggestions contained in the Board's Circular Letters referred to, on the grounds that the Principal Orders do not enable them to delegate their powers, as well as those Local Authorities to whom powers are now extended by the Amending Orders, will move in the matter without further delay. For the information of these latter Local Authorities, copies of the Board's previous Circular Letters on the subject are enclosed.

I am, etc.,

(Signed) A. D. HALL, *Secretary.*

* Order amending the Rats Order, 1918, and the Local Authorities (Food Control) Order (No. 1), 1919. Not here printed.

† Printed in this *Journal*, September, 1919, p. 761.

‡ Not printed in this *Journal*.

§ Printed in this *Journal*, February, 1919, p. 1380.

|| Printed in this *Journal*, March, 1919, p. 1522.

THE Orders of the Ministry of Food and the Local Government Board, amending the Rats Order, 1918, have now been issued. The amendments enable County Councils to delegate

Destruction of Rats. their powers to Agricultural Executive Committees and make the Port Sanitary Authorities and the City of London separate Local Authorities. Subject to the sanction of the County Councils, they also allow the exercise of powers under the Order by the Councils of any District or Borough within the Administrative County. It is hoped that all Local Authorities will now unite in carrying out the Order.

Many County Councils have already recognised the seriousness of the problem and have taken steps to deal with it. In a number of counties the action taken by the Council is restricted to offering a reward for bringing in the dead rats, the payment made ranging from 1½d. to 3d. While this method provides an incentive to kill rats, it does not bring about that thorough and systematic destruction over wide areas which is necessary to ensure satisfactory and lasting results. For this reason reliance upon reward schemes cannot be regarded as sufficient, and in a number of counties more systematic measures have been adopted or are contemplated.

Rat Poisons.—One of the results of the interest now being taken in the rat-destruction campaign is an increased demand by farmers for rat poisons which are non-injurious to human beings or domestic livestock. Perhaps the best poison of this type is the red variety of squills (*Scilla maritima*). Unfortunately, just at present the supplies of this poison are rather short owing to difficulties in importing it; but a number of preparations are on the market in which squills often form the poisonous agency, and the Board will be pleased to supply particulars of these on application.

Where squills can be obtained, the bulbs should be chopped as finely as possible and added to one of the following baits in the proportion of 20 per cent. by weight:—(1) Sausage meat made from horseflesh or inferior meat. (2) Fish, containing as little moisture as possible, passed through a sausage machine. (3) Boiled pounded potatoes or boiled broken rice made into a dough with heated beef dripping, lard (if available) or best lubricating oil. (4) Coarse meal, added to heated treacle, to make a stiff dough.

The baits should be cut up into pieces about the size of a pigeon's egg.

Barium Carbonate (Precipitated).—This is poisonous to human beings and livestock, but it is perhaps the least dangerous of the poisons generally used for killing rats. It is very heavy, and 15 per cent. to 20 per cent. by weight should be mixed with a dough made with meal and sugar—2 parts meal to 1 part of sugar. A few drops of oil of aniseed, caraway, or rhodium should be mixed with the flour, but no other fats should be used.

AN Order (No. 420), dated 3rd April, 1919, has been made by the Food Controller, amending the Live Stock (Sales) Order, 1918,* as subsequently amended, to the effect that:—

**Amendments to the
Live Stock (Sales)
Order, 1918.**

1. In that part of Part II. of the First Schedule to the Principal Order, which is headed "(a) Class A Beasts," 1s. 4½d. shall be substituted for 1s. 4½d. in the column headed "April, 1919," and 1s. 3½d. shall be substituted for 1s. 3½d. in the column headed "August, 1919."

* The text of this Order was not printed in this *Journal*, but a note on its main provisions was published in the issue for June last, p. 350.

2. In that part of Part II. of the First Schedule which is headed “(b) Class B Beasts,” and in that part of Part II. of the Second Schedule which is headed “(b) Class B Sheep,” $\frac{1}{2}d.$ shall be substituted for $2d.$

A further Order (No. 459), dated 16th April, 1919, orders the insertion of the following Sub-clause after Sub-clause (c) of Clause 5 of the Principal Order :—

“(d) Where any in-calf cow or in-calf heifer has been sold for slaughter, and the weight of the calf and bag exceeds 28 lb., the price otherwise payable in respect of the cow or heifer under the provisions of the Order shall (except in the case of a sale by dead weight) be reduced by a sum ascertained in manner hereinafter mentioned, and where the price has been paid to the seller, the Government buyer may recover such sum from the seller.

The sum shall be a sum calculated on the weight of the calf and bag after slaughter, at the maximum rate applicable under this Order on the sale of the cow or heifer.

The provisions of this Sub-clause shall have effect notwithstanding that no proceedings shall have been first taken against the seller in respect of a contravention of Clause 1, and shall be in addition to, and not in substitution for, any penalties in respect of such contravention.”

ACCORDING to a note in the *Board of Trade Journal* (24th April, 1919), the Minister of Munitions announces that the control of nitrate of soda will be suspended on and from 15th

Nitrate of Soda. May, 1919. Transactions will be governed by the present licensing system until that date. General Licences will, however, be issued on application from now till 15th May, 1919, authorising the holders of such licences to deal in nitrate of soda, but such licences will not authorise the holders to enter into any transaction which involves the actual movement of nitrate except within the British Isles before the date mentioned.

All applications for licences should be addressed to the Ministry of Munitions (Department of Explosives Supply), Storey's Gate, S.W. 1.

THE Board of Agriculture have issued a pamphlet describing what farmers should do to collect, preserve, and utilise the liquid manure from cow-houses, stables, etc. Liquid manure, **Liquid Manure Tanks.** the value of which has been recognised for many years by the Continental farmer, is often wasted in this country. In the Board's pamphlet it is shown, by means of a sectional diagram, how simple a matter the storage arrangements can be. Much useful practical advice is given on subjects ranging from the actual shape of the drainage channel in the cow-house to the various methods of building the main storage tank. Copies of the pamphlet can be obtained from The Commercial Secretary, Board of Agriculture and Fisheries, 72, Victoria Street, London, S.W. 1.

AMONG the minor rural industries which the Board of Agriculture desire to place on a more satisfactory basis is bee-keeping. To this end a scheme of local co-operation between societies

Bee-keeping Schemes: of bee-keepers and the county horticultural organisations has been set up.* This scheme is working most satisfactorily in the majority of counties. It provides a means for the re-

Importing Stocks from Holland. stocking of depleted apiaries with imported colonies and queens. Mr. W. Herrod-Hempsall, of the British Bee-keepers' Association, one of the Board's experts in bee-culture, is at present in Holland arranging for the transport of stocks to be supplied on easy terms to the counties, and there used as the basis of large re-stocking enterprises. Every attention is being given to the necessary details with a view to ensuring the success of this effort to rehabilitate an interesting and profitable rural industry which was almost destroyed by the Isle of Wight Disease. For instance, classes have been held in various counties at which the most minute instruction has been provided for local bee-keepers concerning the handling of the Dutch stocks on their arrival. Several counties in particular have taken up this bee scheme with great enthusiasm, notably Lincoln Dorset has lately shown considerable interest also and has organised a series of lectures.

PART of the Government scheme for settling ex-service men on the land takes the form of farm settlements or farm colonies administered directly by the Board of Agriculture. Between

Progress in Settlement of Ex-Service Men.

12,000 and 13,000 acres of land have already been acquired for these settlements, and it is estimated that over 450 ex-service men will ultimately settle on these lands. At present about a quarter of that number have either taken up holdings or are undergoing a period of probationary training at the settlements. Sixteen of the latter on Lady Day this year, having completed their probation, will enter on the occupation of holdings ranging from 7 to 30 acres at the Heath Hill Settlement (Salop). Nine pairs of cottages are to be built here and certain existing houses altered.

At the Rolleston Settlement (Notts) six pairs of cottages are being built, and a number of Army huts will be utilised as a hostel. A similar hostel is being provided at the Amesbury Settlement (Wilts).

At Holbeach 32 ex-service men are in possession of holdings, and a number of men are serving the required probationary period. At Patrington a further 500 acres have been acquired, bringing this farm settlement, which is worked on a profit-sharing system, to the total acreage of 2,865.

The planting of the demonstration fruit plots at Holbeach Crown Settlement (Lincs) is now completed. Another demonstration fruit plot is to be established in Huntingdonshire. At Shippea Hill, West Suffolk, short courses of training for ex-service men in fruit growing and market gardening are being given, and at Brentwood, Essex, instruction in tractor driving.

* See this *Journal*, January, 1919, p. 1222.

A TEST case was recently heard in Norfolk in order to obtain a legal decision on the question of whether lump sums, such as harvest-money, Michaelmas-money, etc., could be spread over a period as part of wages for the purpose of making up weekly wages to the minimum. The decisions given cover three cases: the payment of harvest-money, the payment of Michaelmas-money to which the worker has a contractual right, and the payment of special sums, such as commission on the number of rams or other stock let or sold.

Agricultural Wages
 * (Harvest-money,
 Michaelmas-money,
 etc.).

In the case of the harvest-money, the Bench ruled that harvest-money is wages within the meaning of the Act, but it is wages for special work, and therefore only applicable to harvest weeks.

With regard to the payment of Michaelmas-money, the decision given by the Bench was based on a case in which this payment formed in effect part of the contract between employer and worker. The money would therefore have been recoverable proportionately at any time by the workman, and the Bench took the view that it might therefore be reckoned as part of his wages for the period covered by the contract; that is, before Michaelmas. This decision clearly only applies, however, to case in which the payment of Michaelmas-money is definitely included in the worker's contract.

In the case of commission on stock let or sold, the Bench ruled that the sum to be paid in commission, being an uncertain total, not ascertainable beforehand and not recoverable by the workman until it fell due, could not be spread to cover non-payment of the minimum wage in other weeks. (*Wages Board Gazette*, 15th April, 1919).

A NUMBER of questions have recently been raised as to the conditions on which pupils may be taken by farmers without the farmer being under an obligation to pay the minimum rates. It must be clearly understood that all workers employed in agriculture under a contract of service or apprenticeship come within the scope of the minimum rates of wages fixed by the Board. If, therefore, a farmer desires to take a pupil and not to be under an obligation to pay him at the minimum rates, it would be essential that the arrangements made between them should not constitute a contract of service or apprenticeship. It is not, however, possible for the Board to lay down any general rule as to what arrangements would satisfy this condition, since this must depend upon the circumstances of each particular case. (*Wages Board Gazette*, 1st May, 1919).

**Farm Pupils and the
 Minimum Wage.**

THE attention of farmers is drawn to the fact that no worker employed in agriculture may be paid at less than the minimum rates of wages applicable to him under the Wages Board's Orders, unless a Permit of Exemption has been granted to him under Section 5 (3) of the Corn Production Act. Under the provisions of the Section in question, any worker who by reason of any mental or physical infirmity or physical injury is incapable of earning the minimum rate of wages applicable to him, is entitled to apply to the District Wages Committee for his area for a Permit exempting his employment from payment at the full minimum

**Rates of Wages for
 Infirm or
 Disabled Workers.**

rate. An employer may also apply for a Permit in respect of any such worker in his employment. The mere fact that a worker is incapable of earning the minimum rates does not in itself exempt the employer from his obligation to pay wages at not less than the minimum rate, unless a Permit is issued to the worker. Forms of application for Permits of Exemption may be obtained from the Secretaries of the respective District Wages Committees. The address of the local Secretary of the District Wages Committee, if not known, can be obtained on inquiry of the Agricultural Wages Board, 80, Pall Mall, S.W. 1.

PROCEEDINGS were heard at Lytham on Thursday, 17th April, against an employer in Lancashire in respect of the underpayments of two male workers. An inspector visited the employer in January and found that one of his workers had been underpaid, and that a sum of £6 arrears of wages was owing. The employer undertook to pay the arrears, but in February no receipt for the arrears having been received, the Inspector paid another visit and found that two more men had been engaged, neither of whom was being paid the minimum wages. Proceedings were then taken against the employer. With regard to one worker the Bench considered that only a technical offence with extenuating circumstances had been committed and dismissed the case. In the case of the second worker a fine of 20s. was imposed, and £3 3s. costs, and the employer ordered to pay arrears from a date in February.

An employer was summoned at Fareham on Monday, 28th April, for payment of seven workers at less than the minimum rates, and for giving false information to the Inspector with regard to two of these workers. The Inspector, when he visited the farm in December, found that practically all the male workers had been underpaid up to two weeks prior to his visit. Arrears were paid, the farmer stating that he did not know of the new rates until the middle of November. In his account to the Inspector of his workers and their wages, he omitted to include two workers who were subsequently found to have been underpaid, and also gave false information as to the nature of the employment of two men, paying them arrears as ordinary labourers instead of as carters, in which capacity they were employed. The defendant was fined £45, and £15 costs. (*Wages Board Gazette*, 1st May, 1919.)

THE Board desire to give notice that the particulars of the routes of the stallions to which premiums have been awarded by the Board for the Service Season 1919, together with the names and addresses of the owners of the stallions, and of the members of the Stallion Committees which have been appointed to supervise the service arrangements, will not be published in this *Journal*. Copies of a list of the names and routes of these stallions may be obtained on application to the Board's Offices, 4, The Sanctuary, Westminster, London, S.W. 1.

**Names and Routes
of the Super. King's
and Board's
Premium Stallions.**

THE Meteorological Office will, as in past years, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of a registration fee of 1s. and the cost of the telegrams, computed at 9d. per day. The supply of forecasts will continue until 30th September. The forecasts are drawn up each week-day at 4.30 p.m., and refer to the probable weather during the 24 hours comprising the following civil day. If the meteorological conditions are sufficiently definite, a "further outlook" extending the period covered to two or three days will be added.

Harvest Weather Forecasts.

Notifications will also be issued in connection with the continuance or break up of spells of fine weather. For this service a fee of 6d. is charged for each telegram despatched, in addition to the Post Office charges for telegraphy. A minimum sum of 5s. against which the charges may be booked must be deposited with the Office.

Applications for the forecasts should be sent to the Director, Meteorological Office, South Kensington, London, S.W. 7, with a cheque or postal order payable to the Meteorological Committee, to cover the cost of the telegrams for the period during which the forecasts are to be sent.

Applications for the forecasts should be sent to the Director, Meteorological Office, South Kensington, London, S.W. 7, with a cheque or postal order payable to the Meteorological Committee, to cover the cost of the telegrams for the period during which the forecasts are to be sent.

A Leaflet (No. 329)* has been issued by the Board, giving an account of the principal provisions of the Tithe Act, 1918, for the redemption of Tithe Rentcharge, Corn Rents, etc. Under these provisions a landowner may, as a rule, effect redemption without obtaining the consent of the tithe-owner, while the terms for redemption laid down by the Act are considerably more favourable to the landowner than those presented by the earlier Acts. The consideration may still be paid in cash, but provision is now made for the discharge of the consideration in certain cases, when so desired, by means of an annuity payable for a period not exceeding 50 years, and examples are given in the Leaflet of the method of calculating both the gross amount of the consideration and the amount of the corresponding terminable annuity.

The Tithe Act, 1918.

Copies of the Leaflet will be supplied free on request to the Secretary of the Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1. Letters so addressed need not be stamped.

Copies of the Leaflet will be supplied free on request to the Secretary of the Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1. Letters so addressed need not be stamped.

THE President of the Board of Agriculture and Fisheries has appointed a committee to inquire and report what steps should be taken to render the work of the Royal Botanic Society of London as useful as possible from the scientific and educational point of view.

Royal Botanic Society: Appointment of Committee of Inquiry.

The Committee will be constituted as follows:—

Lieutenant-Colonel Sir David Prain, I.M.S., C.M.G., F.R.S., Director of the Royal Botanic Gardens, Kew.

Sir William Henry Dunn, Bart., of the Royal Botanic Society of London.

Surgeon-General Sir Alfred Keogh, G.C.B., G.C.V.O., etc., of the Imperial College of Science and Technology.

* See Article on p. 155.

Sir Malcolm Morris, K.C.V.O., of the Royal Botanic Society of London.

Major Robert Cattley Carr, of the Royal Botanic Society of London.

Mr. Morton Evans, Joint Secretary of the Office of Woods.

Mr. Hubert John Greenwood, J.P., L.C.C., of the Royal Botanic Society of London.

Professor Frederick W. Keeble, C.B.E., F.R.S., D.Sc., of the Board of Agriculture and Fisheries and the Royal Horticultural Society.

Lieutenant-Colonel Sir David Prain, I.M.S., C.M.G., F.R.S., will be Chairman, and Mr. George Cecil Gough will be Secretary of the Committee.

It is pointed out that the Board of Agriculture have already anticipated the suggestion of Mr. Alfred Davies, M.P., for Lincoln, that the surplus stores of Government Departments should be sold in such places and quantities as would give small men all over the country an opportunity to purchase.

**Selling Surplus
Government Stocks.**

The surplus horses, tractors, etc., used under the aegis of the Food Production Department for the War emergency ploughing programme, have been disposed of in this way gradually for some months past. Farmers who had been using horses on loan, and were accordingly accustomed to the animals, have been given the opportunity to buy them at local auctions, and the harness, implements, etc., have also been placed on sale locally. In the same way, as the tractors finish their work under the county committees and are withdrawn from service, they are being publicly auctioned off in the counties where they have been working. None of the Food Production Department surplus stores has been sold privately or in large lots to dealers. Moreover, the Board of Agriculture have made a point of asking the Disposal Board to sell a fair proportion of the demobilised Army lorries at rural centres so that individual farmers or farmers' co-operative societies may have a fair chance of purchasing them.

It may be added that good prices have been obtained for the Food Production Department horses—one week's average price was £76 per horse; and over 4,500 horses have so far been disposed of at an average price of over £62. Nearly 200 different auction sales of tractors have been held, and they are continuing at the rate of about a score per week.

It has been decided by the War Office to retain for agriculture up to 20 per cent. of soldiers at present employed on the land, in and attached to agricultural companies, in addition to those men whose application for demobilisation as pivotal men had been sanctioned by the Ministry of Labour before 1st February, 1919. These men will be selected by War Agricultural Executive Committees in England and Wales and by Sub-Commissioners in Scotland in conjunction with agricultural commandants, and will be nominated from those considered to be indispensable.

All other soldiers employed on agriculture will be withdrawn.

It has also been announced that a fortnight's notice would be given to farmers before the withdrawal of men attached to agricultural companies.

At a meeting of the Agricultural Wages Board held in London on 8th and 9th May, the Board, after consideration of the objections which had been lodged to their Proposal of 1st April to vary the minimum rates of wages for male workers of 18 years of age and over throughout England and Wales, and of the reports made on the Proposal by the various District Wages Committees, decided to confirm their Proposal except as respects ordinary labourers in Cumberland and Westmorland (in regard to which the District Wages Committee will again be consulted), and as respects the special rates for special classes of workers such as stockmen, horsemen, cowmen, etc., in Hertfordshire, Kent, Middlesex, Northamptonshire, Salop, Surrey, Sussex, and Wiltshire. In the case of these counties the Board propose that the special classes of workers shall be paid at the minimum and overtime rates applicable to ordinary labourers.

The variation made by the Wages Board (which will come into operation on the 19th May) is as follows :—

(a) A reduction in the hours for which the minimum wage for ordinary labourers is payable, to 54 in "Summer" and 48 in "Winter," in the counties where such hours have been in excess of these hours.

(b) An addition to the weekly wages at present payable to ordinary labourers, of the following sums (subject to slight adjustment to round sums) :—

Workers of 18 and under 19 years of age, 3s. a week,

" " 19 " " 20 " " 4s. "

" " 20 " " 21 " " 5s. "

" " 21 years and over, 6s. 6d. a week,

with corresponding adjustments of the overtime rates on the basis of time and a quarter on weekdays and time and a half on Sundays.

In the case of these counties where the number of hours per week are in excess of 54 in Summer and 48 in Winter, the above additions will be made, not to the present weekly wages, but to the *present weekly wages reduced to a basis of 52 hours all the year round.*

(c) An increase in the special rates fixed for special classes of workers such as Horsemen, Stockmen, Shepherds, etc., by amounts corresponding to the increase in the rates for ordinary labourers, except as regards the eight counties referred to above.

The Wages Board have at present under reconsideration the special rates for Horsemen, Stockmen, Shepherds, etc., with a view to a modification of the basis of "customary" hours for which those workers are paid in a number of counties, but they were not legally in a position to give effect to any alteration in this basis at the moment, and they considered that in the meantime these workers should not be deprived of the increase granted to other workers, even where it involved making a new rate which may only be in operation for a short time.

A Schedule of the new minimum rates fixed for each county will shortly be obtainable on application to the Agricultural Wages Board.

AN Order entitled the Seeds, Nuts, Kernels, Oils and Fats (Maximum Prices) Order, 1919, dated 28th April, 1919 (Order No. 509) has been made by the Food Controller, fixing maximum prices for seeds, nuts and kernels, crude oils, deodorised oils and refined and finished common edible oils.

**The Seeds, Nuts,
Kernels, Oils and Fats
(Maximum Prices)
Order, 1919.**

The Edible Oils (Maximum Prices) Order, 1919, is revoked by this Order.

**Revocation of Statutory
Rules and Orders
affecting Farmers.**

THE following Orders have recently been revoked by the Food Controller :—

No. of Order.	Title of Order.	Page of <i>Journal</i> in which Order was Published.
Nos. 1186 of 1917 and No. 370 of 1918.	The Food Control Committees (Milk Requisition) Order, 1917, as amended.	December, 1917, p. 1029, and April, 1918, p. 114.
No. 1224 of 1917..	The Oils, Oil Cakes and Meals (Requisition) Order, 1917. (Re- voked only so far as it relates to Oil Cakes, Meals and residues).	December, 1917, p. 1046.
No. 1316 of 1917..	The Cattle Feeding Stuffs (Committees) Order, 1917.	January, 1918, p. 1142.
No. 58 of 1918 ..	The Cattle Feeding Stuffs (Re- quisition) Order, 1918.	February, 1918, p. 1308.
No. 173 of 1918 ..	The Cattle Feeding Stuffs (Maximum Prices) Order, 1918.	March, 1918, p. 1474.
No. 1308 of 1918..	The Cattle Feeding Stuffs (Distribution) Order, 1918.	November, 1918, p. 1008.

IN devising measures for the destruction of rats, it should be borne in mind that prevention is better than cure. Much can be done to discourage the pests if granaries and all

Destruction of Rats. receptacles for storing foodstuffs are made rat proof, and the farmyard kept free from all garbage and waste food ; they will find little to eat and will take baits more readily.

It is also important to make use of any device which will prevent the introduction of rats into ricks. The ideal method is to build stacks on staddle or stances. Boxes containing poisons can then be placed under the stacks so that they are accessible to rats, but are out of the reach of other animals.

When stacks are built directly on the ground a securely erected 4-ft. fence of fine meshed wire should be placed round the stacks. The stacks and wire fencing should be periodically inspected between the time of building and threshing the ricks.

The wire netting should always be used during threshing operations in case rats have by some means gained access to the stack. The wire netting should be about 8 ft. from the stack ; it should be bent inward during threshing and outward in the autumn.

THE Board's scheme for the agricultural training of ex-service officers and men of "suitable educational promise" is developing satisfactorily. Up to 10th May over 500 officers and men had been approved for training on selected farms in England and Wales, and upwards of 200 of these had already taken up their training on farms in 38 different counties. Numerous other applications are still being dealt with, and fresh ones are being received daily.

**Agricultural Training
of Ex-Officers
and Men.**

In most of the counties farmers have shown great keenness to co-operate with the Government in training ex-service officers and men; but in one or two counties difficulty is being experienced in finding up-to-date farms for the purpose. The Board will accordingly welcome communications from farmers of standing who, by assisting in the training of these men, would like to show their appreciation of the debt due from the country to those who have been engaged in defending it against the enemy.

The scheme (which is part of the general Government scheme for the training and placing of ex-service officers and men) came into operation at the end of January last. Provision is made for two kinds of assistance to officers and educated men who need Government financial help for agricultural training; those who are suitable and wish to be trained to farm are placed with selected farmers; those who are suitable and wish for training for salaried agricultural posts which may eventually be available (such as agricultural organisers, teachers of agriculture, county instructors, managers, etc.) and who have previous scientific knowledge, or practical training, or both, may be able to obtain scholarships to be held at approved Universities or Agricultural Colleges. Both classes of candidates receive certain Government allowances during their training which may last for two or three years. Full details of the scheme are given in a booklet, "Officers Land Settlement in the Mother-Country,"* copies of which may be obtained free on application to the Board, 4, Whitehall Place, London, S.W. 1.

The farm training part of the scheme is in the hands of the Local Authorities throughout the country and the selection of the candidates for training on farms, as well as the farmers, is made by Committees of the County Councils.

The award of the agricultural scholarships to be held at Universities or Agricultural Colleges is made by a Headquarters Departmental Committee of Selection. It was originally proposed to award only 50 agricultural scholarships, but the applications have been so numerous, and the standard of officer applying is so high, that it is proposed to increase the number to 100. The salaried posts in agriculture—official and otherwise—likely to be available are comparatively few in number, and the Board do not feel, therefore, that they can encourage more than a small number of ex-service officers and men to seek a professional career in this direction.

* See this *Journal*, February, 1919, p. 1311.

FARMERS will be interested to learn that, subject to the approval of Parliament, the Government proposes to spend about £2,000,000 on agricultural research and agricultural education during the next five years. In the past, there has been little inducement for any young man or women to take up agricultural research as a career. The pay and prospects have both been poor; and consequently the best types of University men have not been attracted.

**Agricultural
Education Schemes.**

The Board's scheme for the expenditure of the funds now to be placed at their disposal for agricultural education and research will offer substantial scholarships to men who have distinguished themselves in the natural sciences at the Universities. It is believed that many more men would be ready to specialise in agricultural research if they were offered a scholarship of, say, £200 per annum for a period of years, and afterwards given opportunities of earning adequate salaries in research work. From the more successful of these students a certain number will be selected for appointments in Universities and other institutions.

The kind of research that it is proposed to encourage is already represented in this country at Cambridge, Rothamsted, Bristol and Reading. At present there are probably not more than forty men in England and Wales engaged on pure research in agricultural science, but it is hoped that during the next decade or so it will now be possible to raise the number to about 150.

Another feature of the Board's scheme will be the encouragement of higher agricultural education in colleges by means of grants and in other ways. There are already about a dozen agricultural colleges in England and Wales, but hitherto they have not been patronised to any extent by farmers, who often complain that the education given is abstract and theoretical rather than practical. It is hoped in the future that the demonstration farm and the farm institute will bring the farmer into more sympathetic touch with the colleges.

A third section of the scheme will help the farmer, the small holder, and the ambitious labourer more directly. Most of the County Education Committees provide agricultural and horticultural education. As a rule they maintain a travelling staff which advises farmers, organises classes and so on. Adequate funds will now be available to treat these Committees generously. For every £1 the Local Authorities expend on agricultural education they will now receive at least £2 from the State.

With this inducement the majority of the counties should set up farm schools or farm institutes where men may go for winter courses and women for summer courses, and where school teachers may be instructed in the agricultural and horticultural subjects to be taught in the new continuation schools. Lancashire, Yorkshire, Essex, and a few other counties, have spent money freely in the past in this way; many counties, however, have done little or nothing.

Now that it is known that the rate of assessment of farming profits to Income Tax is to remain unaltered for at least another year, farmers will be considering the possibility of keeping

Income Tax and accounts so that they can claim any relief to
Farm Book-keeping. which they may be entitled. Farming profits are charged under Schedule B unless the farmers specially request to be charged under Schedule D. If the farmer chooses

to be assessed under Schedule D he will be charged on the average profits made during the three years preceding the year of assessment, and it will, therefore, be necessary to have kept accounts over this period.

Under Schedule B farming profits are reckoned as equal to twice the full rent of the farm. This, however, does not prevent farmers from claiming relief if they find that the profits fall short of the amount of the assessment. If accounts are kept, therefore, it will be possible in many cases to secure a material reduction in the amount of the tax payable. Although the Income Tax year ends on 5th April, a farmer is not bound to make up his accounts to that time, but to any other date which he may find convenient.

The books kept need not be elaborate or entail much clerical work. Farmers who wish to start accounts should consult Leaflets No. 26 and No. 240, both of which can be obtained free of charge on application to the Board, 3, St. James's Square, London, S.W. 1.

The Agricultural Costings Committee recently appointed by the Board of Agriculture and the Ministry of Food desire to get in touch with farmers who keep accounts for their farm or who are interested in Farm Accounts. Communications should be addressed to the Director, Room 247, Palace Chambers, Westminster, S.W. 1, who will be pleased to furnish any further information desired.

It has recently been announced that the responsibility for the Flax Control Board has by a decision of the Cabinet been transferred to the Board of Trade.

Flax Control. The present members of the Board are being invited to continue to act, with the following amended terms of reference :—" To promote and co-ordinate arrangements, whether by Government Departments or by private enterprise, for the supply and distribution of flax, flax seed, and flax manufactures for Government and civilian purposes, and to take such measures as may be necessary with regard thereto."

All communications with regard to the work of the Board should be addressed to Mr. P. Guedalla, Caxton House, Tothill Street, S.W. 1.

NOTICES OF BOOKS.

Harnessing the Hottest Heat and the Coldest Cold.—F. A. Talbot.—This is a reprint of an article from *The World's Work* for November last, issued by the Nitrogen Products and Carbide Co., Ltd., Winchester House, Old Broad Street, London, E.C. 2. The scope of the article is indicated by the sub-title : " The romantic story of the foundation and development by British effort of the new industry for the fixation of atmospheric nitrogen to restore Britain's agricultural supremacy and wealth."

The fixation of atmospheric nitrogen was stated by Sir William Crookes in 1898 to be one of the great problems of the future,* and its discovery is now an accomplished fact, both as regards the laboratory and the factory.

* See a note published in this *Journal*, May, 1918, p. 249.

The article under notice describes in clear language how coal and lime are fused, under intense heat, to calcium carbide, well known for the acetylene gas it produces. Calcium carbide again, heated in an atmosphere of pure nitrogen, which has been won from the air under conditions of extremest cold, becomes nitrolim or calcium cyanamide. This already before the War, in its handier granular form, was coming into favour as a fertiliser. Its availability for the production of nitric acid, however, which was so much in demand for munitions, prevented temporarily its use for agricultural purposes. The heat required for the production of calcium carbide and nitrolim is provided by electricity, and as this can be generated cheaply by water power, the manufacture of the materials referred to has been carried on chiefly in Norway, though, under stress of War, plants have been installed in this country. Coal, if employed economically enough, can be used to supply the electric power required, and this it is proposed to utilise in the extension of the industry in Great Britain.

Birds Beneficial to Agriculture.—F. W. Frohawk, M.B.O.U., F.E.S., (London: The British Museum (Natural History), Economic Series, No. 9, 1919, 2s.).—This book was prepared at the instance of the Trustees of the British Museum with the object of showing that the majority of British birds exert a beneficial influence on agriculture. It is asserted, in general, that the large number of insects and weed seeds devoured by birds more than compensate for the grain consumed at certain seasons, and that only when the numbers of particular species increase beyond a point they may become harmful by the inadequacy of their natural food leading them to direct attention to other kinds. Descriptions are given of 45 species of birds, and their nesting and feeding habits are briefly stated. The book contains 22 plates which have been reproduced from originals drawn for the purpose by the author.

Land Settlement.—Ministry of Reconstruction (Reconstruction Problems, No. 20), London: H.M. Stationery Office, 1919, 2d. This is one of the series of pamphlets on reconstruction problems issued by the Ministry of Reconstruction, and attempts in the briefest outline to indicate the present position of agriculture in this country, and to show the lines on which the Government are preparing to carry out their national policy of land settlement, especially as regards ex-Service men. The general conditions of British farming before the War are first stated, and some statistics given as to agricultural holdings and the population engaged in agriculture. It is then pointed out how, as a result of the need for increased food production shown by the War, a Reconstruction Committee under the Chairmanship of Lord Selborne was appointed in 1915 to consider the whole agricultural problem. It is shown that the recommendations of this Committee are being formulated as the agricultural policy of the Government, and the remainder of the pamphlet is devoted to a brief outline of this policy under its various heads, and to the additional facilities which are proposed for the dissemination of information, short-term credit, the supply of agricultural machinery, the promotion of supplementary rural occupations, the reconstruction of village life, and a system of rural transport.

MISCELLANEOUS NOTES.

THE *International Crop Report and Agricultural Statistics* for April, 1919, published by the International Institute of Agriculture,

Notes on Crop Prospects and Live Stock Abroad.

gives particulars concerning the sowing of winter cereals in the Northern Hemisphere. The areas estimated to have been sown with wheat in 1918-19, compared with the areas sown during the corresponding period of 1917-18, expressed as percentages, are as follows:—Denmark 89, France 98, England and Wales 96, Scotland 88, Italy 97, Canada 95, United States 116, British India 66, Japan 93; with rye:—Denmark 103, France 93, England and Wales 95, Italy 100, United States 102; with barley:—France 103, Italy 95, Japan 108; with oats:—France 97, Italy 92.

France.—According to a report published by the Ministry of Agriculture on 26th April, the condition of the crops on 1st April was as follows (figures for April, 1918, in brackets):—Winter wheat, 66 (73); winter barley, 66 (72); winter oats, 65 (70); and rye, 68 (74). (80 = good, 60 = fair). (*Broomhall's Corn Trade News*, 28th April, 1919.)

India.—According to a special official forecast the acreage sown with wheat in India in 1918-19 is 23,425,000 acres, against 35,497,000 acres in 1917-18, and the yield 34,753,000 qr., compared with 47,479,000 qr. last season. (*The London Grain, Seed and Oil Reporter*, 29th April, 1919.)

United States.—According to a report issued on the 8th May by the Statistician of the Department of Agriculture, the average condition of winter wheat and rye in the United States on the 1st May was estimated as follows:—Wheat, 100·5 per cent., compared with 99·8 per cent. on 1st April, and 86·4 per cent. a year ago; and rye, 95·3 per cent. compared with 90·6 per cent. on 1st April, and 85·8 per cent. a year ago. The total yield of wheat is estimated at 899,900,000 bush. against 558,449,000 bush. last year, and rye at 122,900,000 bush. against 89,103,000 bush. (*The London Grain, Seed and Oil Reporter*, 9th May, 1919.)

Australia.—According to the latest estimate the Australian wheat crop in the year 1918-19 is given as 76,080,637 bush., compared with 111,865,514 bush. in 1917-18, and 152,420,189 bush. in 1916-17. (*Broomhall's Corn Trade News*, 25th April, 1919.)

Live Stock in Denmark.—The numbers of live stock on the 15th July, 1918, compared with the numbers on the 12th July, 1917, the latter being shown in brackets, are as follows:—horses, 544,999 (572,412); cattle, 2,123,722 (2,458,158); sheep, 470,051 (480,007); pigs, 620,880 (1,650,623). (*International Crop Report and Agricultural Statistics*, April, 1919.)

Live Stock in Luxemburg.—The numbers of domestic animals according to the census of the 8th November, 1918, are as follows (the corresponding numbers on the 18th October, 1917, being shown in brackets):—horses, 17,012 (17,282); cattle, 108,004 (114,277); pigs, 94,957 (113,671). (*International Crop Report and Agricultural Statistics*, April, 1919.)

Live Stock in Switzerland.—The following are the provisional figures of the census taken on the 19th April, 1918 (the comparative figures on the 19th April, 1916, being shown in brackets):—horses, 128,644 (136,836); cattle, 1,530,165 (1,615,893); sheep, 225,081 (172,938); pigs, 364,468 (544,563); goats, 354,716 (358,887). (*International Crop Report and Agricultural Statistics*, April, 1919.)

Live Stock in Tunis.—The numbers of live stock on the 30th April, 1918, are as follows (the corresponding figures on the 30th April, 1917, being shown in brackets):—horses, 35,831 (32,960); asses, 84,639, (77,051); cattle, 251,490 (224,912); sheep, 1,124,998 (1,033,173); goats, 548,912 (459,634); camels, 105,037 (111,027). (*International Crop Report and Agricultural Statistics*, April, 1919).

The Crop Reporters of the Board, in commenting on agricultural conditions in England and Wales on the 1st May, report that in most districts April was a rather unfavourable month for cultivation, although in some parts, more especially the north-eastern, good progress was made. All work, however, is still very backward, and a great deal of the spring corn yet remains to be sown. Winter wheat is generally quite satisfactory, except on heavy and wet soils; and other winter corn crops are healthy and promising. Comparatively few of the spring-sown crops have yet appeared above ground, but such as have sprouted are showing a good plant. Warmer weather is generally needed.

Owing mainly to the lateness in sowing the spring corn crops, comparatively little potato planting has yet been done, apart from the earlies. In most parts of the country planting of the main crop has hardly commenced, and in some instances the preparation of the land for this crop is not yet complete.

Reports on clovers and rotation grasses are not very satisfactory in the north and west, they are generally patchy and thin, and of course very backward. In the south-eastern half of the country, however, reports are generally much better, and seeds are mostly promising, but have made little growth and are late.

Pastures are still very backward, there not having been warmth enough to enable the grass to grow; winter keep has also been getting short. Livestock have made little progress during the month, and are generally in poor condition.

The fall of lambs has everywhere been about normal; but the inclement weather has caused losses to be perhaps slightly heavier than usual, both among the lambs and the ewes. The latter are not in very good condition.

Labour is in nearly all parts reported to be short, difficulty having everywhere been experienced in getting horsemen and cattlemen more particularly, as well as other forms of skilled labour. A few districts report that the situation is easier.

THE following local summaries give further details regarding agricultural labour in the different districts of England and Wales :—

**Agricultural
Labour in
England and Wales
during April.**

Northumberland, Durham, Cumberland, and Westmorland.—The supply of labour, both skilled and unskilled, is almost everywhere deficient. Horsemen and ploughmen are particularly mentioned as difficult to obtain as well as casual labour. The withdrawal of soldiers has made the position more difficult.

Lancashire and Cheshire.—The supply of labour is still very short, particularly of skilled hands, men being attracted to other industries by the high wages offered.

Yorkshire.—Labour is deficient almost everywhere, and often very scarce, particularly among skilled men, such as horsemen and cattlemen.

Shropshire and Stafford.—Practically throughout the division the supply of labour is very short. Horsemen, cattlemen and waggons are particularly in demand.

Derby, Nottingham, Leicester, and Rutland.—The supply of labour is still somewhat deficient, especially as regards horsemen and cattlemen.

Lincoln and Norfolk.—The supply of labour is generally deficient, horsemen and cattlemen being frequently difficult to obtain.

Suffolk, Cambridge, and Huntingdon.—The supply of labour throughout the division is variable ; whilst the general situation appears to be somewhat easier, there is still a great shortage in some districts.

Bedford, Northampton, and Warwick.—Labour is frequently insufficient. In many districts the shortage applies to all classes, but the need appears to be greatest in the case of horsemen and cattlemen.

Buckingham, Oxford, and Berkshire.—The supply of labour in a few districts is about sufficient, but in most there is a general shortage.

Worcester, Hereford, and Gloucester.—The supply of labour is generally short, especially of skilled hands, and the withdrawal of soldiers from the land may be felt.

Cornwall, Devon, and Somerset.—The supply of labour is still short, particularly of horsemen and cattlemen, and with improvement in the weather the shortage will be more apparent.

Dorset, Wiltshire, and Hampshire.—The supply of labour is deficient, especially skilled men, and the withdrawal of military labour is likely to be felt.

Surrey, Kent, and Sussex.—The supply of labour is variable, being sufficient in some districts and short in others. Skilled hands, however, are still deficient.

Essex, Hertford, and Middlesex.—The position varies in different districts. On the whole the supply of unskilled labour is perhaps sufficient, but there are local shortages of skilled men, and in a few districts a general shortage is reported.

North Wales.—Labour, especially skilled labour, is still deficient, teamsmen being particularly scarce in some areas. An improvement in the supply is reported from one or two districts.

Mid Wales.—Labour is on the whole scarce though a few districts have sufficient for their requirements.

South Wales.—The supply of labour, especially temporary, is very short, and the shortage is being seriously felt by the farmers in some districts, especially as many of the demobilised men are not returning to the farms.

The Weather in England during April.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	*F.	*F.	In.	Mm.*	Mm.*		Hours.	Hours.
<i>Week ending 5th April:</i>								
England, N.E. ...	39.9	-3.2	0.13	3	-4	2	4.9	-0.6
England, E. ...	38.6	-5.4	0.04	1	-6	1	6.0	+0.4
Midland Counties ...	39.0	-5.2	0.07	2	-7	2	4.7	-0.4
England, S.E. ...	39.0	-6.6	0.05	1	-7	1	6.7	+1.1
England, N.W. ...	39.3	-4.6	0.30	8	-3	3	4.1	-1.1
England, S.W. ...	39.0	-6.3	0.14	4	-9	2	6.0	-0.8
English Channel ...	41.9	-5.7	0.17	4	-6	3	8.9	+3.0
<i>Week ending 12th April:</i>								
England, N.E. ...	47.1	+3.6	0.14	4	-6	3	3.7	-1.2
England, E. ...	47.1	+2.3	0.30	8	-2	5	3.1	-2.1
Midland Counties ...	47.6	+2.8	0.28	7	-3	5	3.1	-1.6
England, S.E. ...	47.1	+1.2	0.45	12	+3	4	3.0	-2.3
England, N.W. ...	47.1	+2.7	0.39	10	-2	5	3.9	-1.1
England, S.W. ...	47.0	+1.0	0.59	15	+2	6	4.1	-1.4
English Channel ...	47.8	-0.1	0.64	16	+6	5	4.0	-2.3
<i>Week ending 19th April:</i>								
England, N.E. ...	46.9	+2.1	0.55	14	+6	4	3.4	-1.7
England, E. ...	47.4	+1.6	0.70	18	+11	5	4.3	-1.3
Midland Counties ...	47.4	+1.6	0.65	17	+9	4	3.9	-1.1
England, S.E. ...	48.3	+1.4	0.88	22	+14	4	4.8	-1.0
England, N.W. ...	46.0	+0.1	0.60	16	+6	4	3.1	-2.4
England, S.W. ...	46.9	+0.1	0.86	22	+11	3	5.0	-0.6
English Channel ...	48.9	0.0	0.63	16	+6	3	7.4	+0.8
<i>Week ending 26th April:</i>								
England, N.E. ...	44.2	-1.8	0.19	5	-6	3	5.0	-0.3
England, E. ...	43.3	-4.1	0.31	8	-4	3	3.1	-2.8
Midland Counties ...	44.4	-3.0	0.27	7	-6	3	5.2	-0.2
England, S.E. ...	45.3	-3.2	0.21	5	-9	2	4.3	-1.7
England, N.W. ...	44.6	-2.5	0.34	9	-5	4	6.5	+1.3
England, S.W. ...	45.6	-2.5	0.23	6	-13	2	7.6	+1.7
English Channel ...	48.2	-1.8	0.07	2	-12	2	9.0	+2.3

* 1 inch = 25.4 millimetres.

AVERAGE PRICES of British Wheat, Barley, and Oats at certain Markets during the Month of April, 1917, 1918, and 1919.

	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919.	1917.	1918.	1919.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	86 2	73 9	72 11	71 8	56 0	61 6	59 10	...	50 9
Norwich ...	82 6	73 1	72 11	68 10	56 3	62 11	57 0	45 7	49 1
Peterborough ...	82 7	72 7	72 7	66 7	56 5	62 1	58 11	43 10	47 10
Lincoln ...	83 8	72 9	73 4	69 4	56 2	63 1	58 1	48 0	47 11
Doncaster ...	84 11	72 9	72 8	70 1	56 0	62 11	56 9	...	46 5
Salisbury ...	82 7	72 10	72 5	68 6	56 3	61 9	57 4	44 0	46 10

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1917, 1918 and 1919.

Weeks ended (in 1919).	WHEAT.						BARLEY.						OATS.					
	1917.		1918.		1919.		1917.		1918.		1919.		1917.		1918.		1919.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan. 4 ..	76	0	71	2	72	2	66	4	58	0	62	3	47	1	45	5	48	8
" 11 ..	75	8	71	2	72	6	65	7	58	2	62	5	47	2	46	9	49	8
" 18 ..	75	8	71	3	72	7	64	9	58	1	62	3	47	4	47	9	50	0
" 25 ..	75	10	71	1	72	7	64	5	58	7	61	10	47	8	48	2	49	6
Feb. 1 ...	75	10	71	2	72	8	64	0	58	10	62	4	47	3	50	2	49	7
" 8 ...	76	0	72	0	72	7	63	5	59	0	62	3	46	11	50	6	49	2
" 15 ...	76	3	72	3	72	8	63	8	58	11	62	5	47	3	52	0	49	0
" 22 ...	76	9	72	2	72	8	63	9	58	9	62	6	47	8	52	3	49	4
Mar. 1 ...	77	4	72	2	72	7	64	0	57	9	62	7	48	0	52	0	48	8
" 8 ...	78	0	72	3	72	6	63	7	58	5	62	7	48	7	52	2	48	6
" 15 ...	78	10	72	4	72	5	64	1	56	10	62	5	49	4	51	0	46	8
" 22 ...	80	3	72	3	72	7	65	6	56	9	62	1	50	4	50	3	46	4
" 29 ...	81	5	72	4	72	7	71	10	56	7	62	8	51	10	48	10	46	11
Apr. 5 ..	84	4	72	11	72	6	69	11	56	7	62	8	55	1	49	10	47	2
" 12 ..	85	2	73	3	73	0	71	10	56	6	62	9	57	2	47	2	47	1
" 19 ...	84	10	73	3	73	1	70	6	56	6	62	9	59	8	47	0	47	3
" 26 ...	81	1	73	3	73	1	69	5	56	10	62	9	58	6	46	8	48	1
May 3 ..	77	7	73	5	73	2	64	4	56	5	62	8	54	9	47	4	48	7
" 10 ...	78	0	73	5	73	2	64	11	56	6	63	1	55	2	47	6	47	5
" 17 ...	77	11	73	4			64	10	56	6			55	2	46	4		
" 24 ...	78	0	73	3			64	9	56	6			54	11	47	8		
" 31 ...	78	0	73	8			65	11	60	0			54	11	44	9		
June 7 ...	78	0	73	11			67	7	59	2			55	0	45	5		
" 14 ...	78	2	74	3			75	6	57	9			55	1	45	7		
" 21 ...	78	1	74	4			75	0	58	5			55	2	47	8		
" 28 ...	78	3	74	4			73	11	57	10			55	1	46	4		
July 5 ..	78	1	74	4			69	5	61	7			55	2	46	10		
" 12 ...	78	2	74	4			70	10	57	5			55	1	47	0		
" 19 ...	78	3	74	3			72	1	60	5			55	2	45	4		
" 26 ...	78	3	74	3			65	7	56	11			55	2	46	2		
Aug. 2 ...	78	2	74	3			73	6	57	1			55	0	45	10		
" 9 ...	78	4	74	7			76	1	57	7			55	0	46	3		
" 16 ...	78	7	74	2			68	11	61	4			55	6	55	11		
" 23 ...	76	7	74	8			70	7	62	6			54	7	56	9		
" 30 ...	72	1	74	8			60	4	60	1			49	0	57	11		
Sept. 6 ..	71	6	72	3			59	3	60	4			46	7	56	9		
" 13 ...	70	7	72	5			57	2	60	1			45	0	49	2		
" 20 ...	70	8	72	6			56	10	60	4			45	8	49	11		
" 27 ...	70	6	72	7			58	5	60	3			44	7	50	3		
Oct. 4 ...	70	8	72	8			57	9	60	3			44	9	50	9		
" 11 ...	71	0	72	6			58	5	60	3			44	5	51	6		
" 18 ...	70	8	72	7			59	3	60	3			44	1	50	9		
" 25 ...	70	10	72	5			60	1	60	3			43	0	50	5		
Nov. 1 ...	70	4	72	4			59	11	60	3			42	4	50	8		
" 8 ...	70	3	72	4			60	2	60	3			42	11	49	11		
" 15 ...	70	3	72	5			60	2	60	3			43	0	49	10		
" 22 ...	70	2	72	4			59	9	60	10			43	1	51	1		
" 29 ...	70	2	72	3			59	3	62	2			44	6	50	4		
Dec. 6 ...	70	7	72	4			58	7	62	6			43	5	51	4		
" 13 ...	71	2	72	3			58	0	62	7			43	6	51	4		
" 20 ...	71	1	72	4			57	7	62	3			44	2	50	5		
" 27 ...	71	1	72	3			57	7	62	3			44	10	50	6		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in April and March, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	APRIL.		MARCH.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.
FAT STOCK :—				
Cattle :—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Polled Scots	83 3	78 0	81 8	76 3
Herefords	83 6	77 8	81 4	75 10
Shorthorns	82 11	77 8	80 9	75 8
Devons	83 2	77 9	80 9	75 7
Welsh Runts	83 6	78 0	—	—
Fat Cows	77 10	69 8	75 9	67 9
	First Quality. per lb.*	Second Quality. per lb.*	First Quality. per lb.*	Second Quality. per lb.*
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
Veal Calves	11	9½	12½	10½
Sheep :—				
Downs	14½	14½	14½	14½
Longwools	14½	14½	14½	14½
Cheviots	14½	14½	14½	14½
Blackfaced	14½	14½	14½	14½
Welsh	14½	14½	14½	14½
Cross-breds	14½	14½	14½	14½
	per score. live weight.	per score. live weight.	per score. live weight.	per score. live weight.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Pigs :—				
Bacon Pigs	21 0	21 0	21 0	21 0
Porkers	21 0	21 0	21 0	21 0
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>
Shorthorns—In Milk ...	49 0	36 10	50 0	36 15
—Calvers	44 9	33 15	44 1	33 10
Other Breeds—In Milk ...	44 0	29 16	44 2	32 0
—Calvers	—	—	—	—
Calves for Rearing	3 9	2 10	3 9	2 12
Store Cattle :—				
Shorthorns—Yearlings ...	16 19	13 17	16 9	13 5
—Two-year-olds ..	27 11	22 14	26 2	21 16
—Three-year-olds ...	36 14	31 2	35 0	30 14
Herefords—Two-year-olds...	30 3	27 4	27 0	22 0
Devons—	27 7	22 16	26 15	22 12
Welsh Runts—	27 16	22 13	27 0	22 2
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Downs or Longwools ...	82 9	64 5	72 8	59 10
Store Pigs :—				
8 to 12 weeks old	56 4	41 6	46 10	34 5
12 to 16 " "	93 4	72 0	83 7	62 5

* Estimated carcass weight.

NOTE.—The prices per lb. for sheep do not include the value of the skins or pelts, which during April made prices equivalent to an additional *sd.* per lb. of the carcass weight for Downs, Longwools, Blackfaced, and Cross-breds, *1½d.* for Welsh, and *1½d.* for Cheviots, and during March, *sd.* per lb. for Downs, Longwools and Crossbreds, *1½d.* for Cheviots and Blackfaced, and *1½d.* for Welsh.

In addition to the price quoted above for sheep per lb., sellers were entitled, under the Live Stock (Sales) Order, 1918, to charge an extra amount ranging from *4s.* to *13s. 4d.* per head during April, and *3s.* to *10s.* during March, according to the weight of the sheep.

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at
certain MARKETS in ENGLAND in April, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	—	—	—	—	27 6	—
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
„ Factory	—	—	—	—	—	—
Imported (Controlled)	252 0	—	252 0	—	252 0	—
CHEESE :—						
British—						
Cheddar	144 6	—	—	—	144 6	—
Cheshire	—	—	120 lb. 155 0	—	120 lb. 155 0	—
Canadian	144 6	—	per cwt. 144 6	—	per cwt. 144 6	—
BACON :—						
Irish (Green)	194 6	—	194 6	—	194 6	—
Canadian (Green sides)	185 6	—	183 0	—	189 0	—
HAMS :—						
York (Dried or Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green) (long cut)	179 0	—	176 0	—	180 0	178 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	34 2	31 8
Irish	32 5	—	32 2	30 7	33 0	31 0
Danish	—	—	33 4	31 8	34 0	32 0
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Arran Chief	190 0	170 0	—	203 6	198 0	—
Edward VII.	221 6	199 6	208 6	200 0	207 0	—
Up-to-Date	220 0	190 0	173 6	—	—	—
HAY :—						
Clover	—	—	—	—	—	—
Meadow	—	—	—	—	—	—

**AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in April, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	London.	Man- chester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—						
English	1st	116 6	116 6	—	116 6	116 6
	2nd	116 6	116 6	—	116 6	116 6
Cow and Bull	1st	116 6	116 6	116 6	116 6	116 6
	2nd	116 6	116 6	98 0	102 6	98 0
Irish : Port Killed	1st	—	—	116 6	116 6	116 6
	2nd	—	—	116 6	116 6	116 6
Argentine Frozen—						
Hind Quarters	1st	132 0	132 0	132 0	132 0	132 0
Fore "	1st	101 6	101 6	101 6	101 6	101 6
American Frozen—						
Hind Quarters	1st	129 6	129 6	129 6	129 6	129 6
Fore "	1st	99 0	99 0	99 0	99 0	99 0
Canadian Frozen—						
Hind Quarters	1st	129 6	129 6	129 6	129 6	129 6
Fore "	1st	99 0	99 0	99 0	99 0	99 0
VEAL :—						
British	1st	98 0	98 0	98 0	98 0	98 0
	2nd	98 0	84 0	84 0	84 0	84 0
Foreign	1st	—	—	—	—	—
MUTTON :—						
Scotch	1st	123 6	123 6	123 6	123 6	123 6
	2nd	123 6	123 6	123 6	123 6	123 6
English	1st	123 6	123 6	—	123 6	123 6
	2nd	123 6	123 6	—	123 6	123 6
Irish : Port Killed	1st	—	—	123 6	—	123 6
	2nd	—	—	123 6	—	123 6
Argentine Frozen	1st	123 6	123 6	123 6	123 6	123 6
New Zealand "	1st	—	—	—	—	—
Australian "	1st	—	—	—	—	—
LAMB :—						
British	1st	—	—	—	—	—
	2nd	—	—	—	—	—
New Zealand	1st	123 6	—	123 6	123 6	123 6
Australian...	1st	—	—	—	—	—
Argentine...	1st	123 6	123 6	123 6	123 6	123 6
PORK :—						
British	1st	—	149 6	149 6	149 6	149 6
	2nd	—	—	—	—	—
Frozen	1st	—	—	—	149 6	—

DISEASES OF ANIMALS ACTS 1894 to 1914

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	APRIL.		FOUR MONTHS ENDED APRIL.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	13	27	64	113
Animals attacked	17	28	87	128
Foot-and-Mouth Disease :—				
Outbreaks	—	—	19	—
Animals attacked	—	—	153	—
Glanders (including Farcy) :—				
Outbreaks	2	4	5	13
Animals attacked	12	6	28	36
Parasitic Mange :—				
Outbreaks	485	370	2,603	2,229
Animals attacked	845	711	5,158	4,303
Rabies. —				
Number of cases	28	—	57	—
„ „ Dogs affected	28	—	55	—
„ „ other animals affected	—	—	2	—
Sheep-scab :—				
Outbreaks	15	21	207	222
Swine Fever :—				
Outbreaks	147	128	422	323
Swine slaughtered as diseased or exposed to infection	54	38	149	114

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	APRIL.		FOUR MONTHS ENDED APRIL.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	1
Glanders (including Farcy) :—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Parasitic Mange :—				
Outbreaks	12	12	56	57
Sheep-scab :—				
Outbreaks	25	16	139	151
Swine Fever :—				
Outbreaks	2	1	16	7
Swine slaughtered as diseased or exposed to infection	10	1	57	27

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EDITORIAL NOTES.

A QUESTION of considerable importance is dealt with by Dr. Russell in his article on The Agricultural Value of Organic Manures (p. 228). Certain organic substances have been used for manurial purposes for centuries, and in the last fifty years some of them have come to be regarded as of very great value, not only because of the manurial value of their chemical constituents, but because of their physical influence on the texture of the soil, or their moisture-retention properties, or the fact that they favour the activity of micro-organisms which are beneficial to soil productivity. There is usually a ready, if not keen, market for this group of substances, for which farmers commonly have a much greater predilection than for "artificial." If organic manures and artificial fertilisers are compared strictly on their manurial constituents, it will be found that, based on their market prices, the unit price of the nitrogen in the former is much higher than that in the latter as represented by nitrate of soda and sulphate of ammonia, the two standard substances. For various reasons given in Dr. Russell's conclusions, however, farmers are willing to pay more for the organic substances. From a consideration and comparison of Peruvian guano, rape cake, and shoddy, Dr. Russell concludes that the reasons do not help to suggest a fair price, for "additional value cannot be assessed on the ordinary unit system."

The subject of organic manures is also dealt with in the Board's Leaflet No. 175 (*The Use of Waste Organic Substances as Manures*).

A FEW months ago (September, 1918, p. 621) reference was made in these notes to the institution of village clubs, and an abstract from the Report of the Agri-

Village Life. cultural Policy Sub-Committee touching village reconstruction was given in this *Journal*, July, 1918, p. 400. In the present issue is printed (p. 247) a résumé of a paper by Sir Douglas Newton on the Organisation of the Village. Everyone familiar with rural conditions in this country admits the need for improving the amenities of village life. The difficulties, however, both financial and administrative, are considerable. The financial difficulties are obvious and need not be expanded. The administrative difficulties are, however, even more potent, as the improvement of the conditions of village life involves questions of housing, allotments, clubs, recreation, education, and rural industries, each of which, under present arrangements, is dealt with by a separate authority. Any well-considered scheme for overcoming these difficulties must accordingly be welcomed, and Sir Douglas Newton's suggestions are, therefore, recommended to the attention of all who are giving thought to these problems at the present time.

AT this season of the year most wild plants are in full growth, and may be readily identified. Among them are a considerable number which must be regarded as

Poisonous Plants. more or less poisonous in character, some of them, indeed, being highly toxic and a source of heavy loss to live stock. Whenever an animal is unaccountably taken ill, not only should a veterinary surgeon be called in with a view to diagnosing a disease which may appear with great suddenness, but a botanical examination should be made of the hay or green herbage on which the animal is fed. Such plants as Yew, Meadow Saffron, Dog's Mercury, Hemlock, Water Dropwort, Cowbane, Laburnum, or Celery-leaved Buttercup may quite possibly be found to be the cause of the trouble. In this connection co-operation between the veterinary surgeon and the trained botanist is often very

important, and may prove to be the only means of coming to a conclusion as to the action necessary. Farmers should pay special attention to the possibility of the presence of poisonous plants in their fields.

IN view of the immense damage done by rats, great interest is now being taken by the general public in the subject of their destruction. It is important, therefore,

Destruction of Rats. that farmers should clearly recognise their responsibilities, and do their utmost to combat this pest: unless they do so they will certainly be blamed by the public for permitting preventable waste of the country's food supplies. The fact that farmers are being guaranteed a price for their corn might reasonably be held to involve an assurance on the part of the farmer that loss of grain shall not occur owing to any cause over which he can be regarded as having control. Negligence by a few farmers may not only result in much loss on their own farms, but be the cause of severe infestation on the farms of more careful men. In one of the eastern counties recently the writer saw wheat thrashing in progress. A stack already thrashed had yielded nearly seventy rats killed, and one in process of being thrashed clearly contained many rats and literally swarmed with mice. The yield of best grain was poor, and was mixed with the excrement of rats; the seconds consisted largely of bitten grain and excrement of rats and mice; and the waste was plentiful, finely-bitten grain mixed with the excrement of mice. The loss was probably quite half the grain. Similar losses are occurring in many districts. It should be needless to say that this loss ought not to occur. Farmers are invited to combine forces, and take every step that will tend to the destruction of vermin which have caused, and are still causing, immense loss both to farmers themselves and to the whole nation. Their efforts should receive support from the Local Authority, and where such support is lacking farmers should take steps to ensure that it is forthcoming.

THE AGRICULTURAL VALUE OF ORGANIC MANURES.

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ORGANIC manures have long been used with advantage by farmers. Hair is included in Platt's list in 1653 : woollen rags, the prototype of our present-day shoddy, are mentioned not much later. Rape dust was commonly used in Hertfordshire in Ellis' time, and its effects are fully described in his "Modern Husbandman" published in 1744 ; it had been used in Yorkshire long before the Board of Agriculture Surveys of 1795-1805. Other organic manures have more recently come into use, being as a rule taken up by farmers as soon as they were available.

There has never been any difficulty in persuading farmers to purchase these substances as fertilisers, and despite the fact that they have never been pushed by propagandist committees or controlling syndicates they have always sold better than the artificial fertilisers. Just before the outbreak of war the unit prices were :—

	Percentage Composition.			Price per Ton, Cash.		Unit Value.		
	N.	Phosphate.	K ₂ O.			N.	Phosphate.	K ₂ O.
Peruvian Guano	6	30	2	£	s. d.	s. d.	s. d.	s. d.
Fish	9	8	—	10	5 0	24	0	4 6
Meat	6.5	17	—	9	2 6	19	0	1 9
Rape Cake	4.75	4	—	7	10 0	18	0	1 9
Dried Blood	12	—	—	6	0 0	23	0	—
Horn	12	—	—	12	0 0	20	0	—
Shoddy	12	—	—	6	0 0	10	0	—
Nitrate of Soda	5	—	—	12	0 0	8	0	—
Sulphate of Ammonia	15	—	—	11	10 0	15	4	—
Superphosphate	20	—	—	12	10 0	12	6	—
	—	30	—	12	15 0	—	1 10	—

These prices were solely the result of economic conditions, particularly of supply and demand ; they had no relation to actual values to the farmer. During the War the prices of the units of nitrogen were well above those ruling in the case of sulphate of ammonia. It might, of course, be contended that the material must necessarily be worth these prices or the farmer would not pay them, but such argument is unsound. The actual value to the farmer can only be determined by definite field trials, and unfortunately no great number have been made.

RAPE CAKE.—Rape cake is the oldest of the common organic manures. Ellis' description in 1744 is as follows :—

" Oil-Cake Powder. One thousand of these Cakes makes ten Quarters of Meal, which will manure four Acres of Land well,

for twenty Shillings an Acre ; for this Number of Cakes costs four Pounds at the Oil-mills near *Cambridge City* ; and so great a Stress is laid on this Dressing that at *Sanden* in *Essex*, upon the Borders of that County, lives a Farmer, who erected a Mill on Purpose to grind these Cakes, whose Powder he used instead of Lime, for Wheat, Turneps, Barley, and other Vegetables, and will be serviceable in a great Degree to the next Year's Crop of *Lent*-grain, either plowed in with Wheat-seed, or sown on the Top of that, or Barley, Pease, Clover, Rapes, &c. It is a very fertile Manure for rather more than two Years. Some allow that this Meal or Powder will not wash away so soon as powdered Lime, Malt-dust, and such like."

Arthur Young states that $6\frac{1}{2}$ to 7 qr. of the dust went to the ton : the dressing would, therefore, be equivalent to $7\frac{1}{2}$ cwt. per acre.

Rape cake entered prominently into Lawes' and Gilbert's early experiments and into the Woburn experiments, and a certain number of trials with it have since been made elsewhere.

Modern rape cake usually contains 5 per cent. nitrogen, 2 per cent. phosphoric acid (*i.e.*, about 4 per cent. of phosphate), and 1 per cent. of potash : thus it contains one quarter the nitrogen of sulphate of ammonia and ten times the nitrogen of farmyard manure ; in other words, 10 cwt. per acre would be approximately equivalent to a dressing of 5 tons of dung, and 4 cwt. per acre would be equivalent to 1 cwt. of sulphate of ammonia. In practice a usual dressing is 5 cwt. per acre.

The Rothamsted experiments with rape cake go back to the year 1845. It is given to three of the crops grown continuously on the same land : barley, wheat and mangolds ; a more recent experiment is also made in the Little Hoos field, where a rotation of crops is grown.

Experiments with Cereals.—The results obtained with barley are set out in Table I. (see next page).

The rape cake has been applied at the rate of 1,000 lb. per acre per annum since 1858, though for the first six years it was given at double this rate. The percentage of nitrogen being just under 5, the amount of nitrogen actually added in the rape cake has not been quite the same as that in the sulphate of ammonia or the nitrate of soda, being 49 lb. per acre as against 43 lb.

On an average this 49 lb. of nitrogen from rape cake has not proved as effective as the 43 lb. of nitrogen from nitrate of soda or sulphate of ammonia when potash and phosphate are also applied, though it has been considerably more effective

when these are not given. Indeed the rape cake alone has proved nearly as effective as the complete dressings of artificials.

The experiment teaches a very important lesson. It would be easy for a farmer acting without proper advice to use an

TABLE I.—*Yield of Barley on Hoos Field, Nitrogen obtained from various Sources: Average 60 years, 1852–1911.*

	Grain. Bush. per Acre.			Straw. Cwt. per Acre.		
	Potash and Phosphate supplied.	No Phosphate supplied.	No Phosphate or Potash	Potash and Phosphate supplied.	No Phosphate supplied.	No Phosphate or Potash
49 lb. Nitrogen from Rape Cake	40.5	36.9	38.3	24.5	22.3	22.1
43 lb. Nitrogen from Nitrate of Soda	42.7	30.0	29.3	27.3	19.3	17.8
43 lb. Nitrogen from Sulphate of Ammonia	41.5	28.0	25.5	25.0	16.9	14.7
No Nitrogen	19.7	15.2	12.7	11.1	8.8	8.4
Farmyard Manure	—	—	47.1	—	—	29.6

unsuitable mixture of artificials and so go astray ; with rape cake, however, he can hardly go wrong, and if he puts on too much no great harm will be done. He stands to gain about 10 per cent. more crop if he uses the proper mixture of artificials in the proper manner ; on the other hand, he may easily lose considerably if he applies the wrong mixture. Thus, a man farming the Rothamsted land who used sulphate of ammonia and potash without phosphates would only obtain 28 bush. per acre, whereas with rape cake alone he would obtain at least 10 bush. more. This consideration applies equally to horticulture as to agriculture : the man with little knowledge of artificial manures is safer with rape cake alone than with artificials.

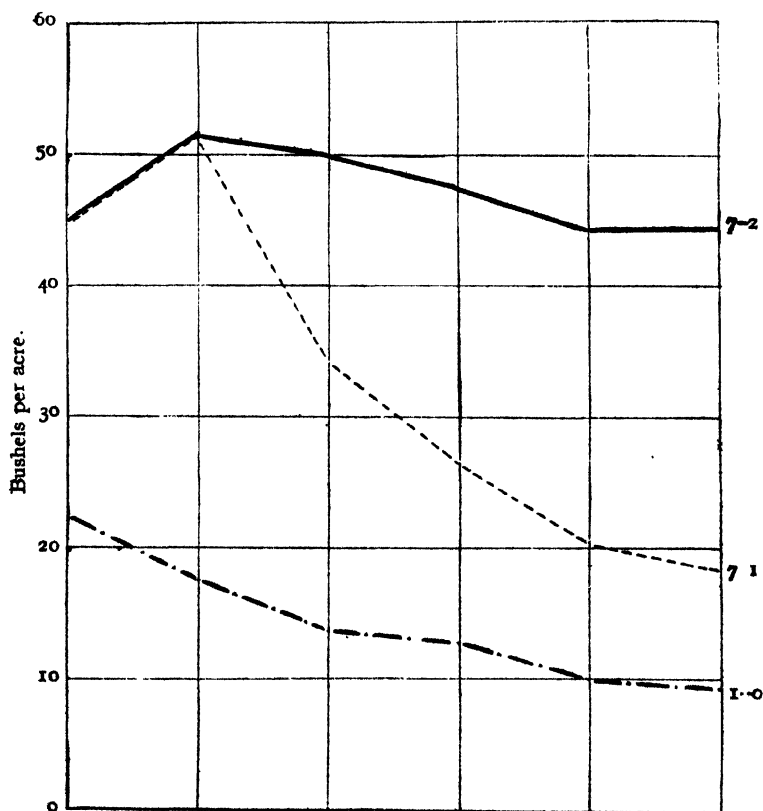
TABLE II.—*Effect of omitting Rape Cake for Two Years from Barley Plots. First Year, 1917.*

	Series.	Grain. Bush. per Acre.			Straw. Cwt. per Acre.		
		Potash and Phosphate supplied. Plot 4.	No Phosphate supplied. Plot 3.	No Phosphate or Potash. Plot 1.	Potash and Phosphate supplied. Plot 4.	No Phosphate supplied. Plot 3.	No Phosphate or Potash. Plot 1.
Rape Cake omitted	C	6.8	7.5	10.7	5.4	5.8	6.8
Nitrogen from Nitrate of Soda	AA	22.4	14.2	14.6	15.2	11.4	12.4
Nitrogen from Sulphate of Ammonia	A	17.2	13.7	11.7	13.1	9.7	8.9
No Nitrogen	O	12.1	7.8	7.9	8.2	5.8	5.3
Farmyard Manure	7.2	—	—	27.7	—	—	19.8

Second Year, 1918.

	Series.	Grain. Bush. per Acre.			Straw. Cwt. per Acre.		
		Potash and Phosphate supplied. Plot 4.	No Phosphate supplied. Plot 3.	No Phosphate or Potash. Plot 1.	Potash and Phosphate supplied. Plot 4.	No Phosphate supplied. Plot 3.	No Phosphate or Potash. Plot 1.
Rape Cake omitted	C	17.3	16.6	18.7	8.9	9.2	9.3
Nitrogen from Nitrate of Soda ..	AA	43.3	21.1	26.7	16.0	13.0	14.7
Nitrogen from Sulphate of Ammonia ..	A	34.9	23.4	25.1	15.7	11.2	11.5
No Nitrogen ..	O	24.0	16.9	18.3	11.5	7.9	7.9
Farmyard Manure	7-2	—	—	58.8	—	—	28.7

*Yield of Barley in successive Ten-Year Periods,
1852-1911.*



1852-61. 1862-71. 1872-81. 1882-91. 1892-1901. 1902-11.

Plot 1-0—Unmanured plot. Plot 7-2—Farmyard manure.

Plot 7-1—Farmyard manure, 1852-71; unmanured, 1872-1911.

In 1917, and again in 1918, rape cake was unobtainable and was, therefore, omitted. Artificials were applied to the other plots as usual. The results obtained are given in Table II.

Although rape cake had been applied for 65 years and a total amount during that time of 32 tons had been added, there is no sign whatsoever of the slightest residual effect. The rape cake seems to have completely vanished, and the yield falls down to the level of the plots that have received no manure since 1852.

The great difference between rape cake and farmyard manure in lasting power is well shown in another experiment in which farmyard manure was applied every year from 1852 onwards, but on one section of the plot it was discontinued from 1872 onwards. For the first 13 years the crop rose: then it remained steady, and where the farmyard manure was applied each year it has kept up to the present day. From 1872 the part of the plot to which no further manure was given began to fall off in yield, but the fall took so long that even to-day, 46 years after the last dressing of dung was applied, the yield is still above that of the unmanured plot. These relationships are shown in Fig. 1.

It thus appears that rape cake does not last in the soil in the same way as farmyard manure. Whatever effect it is going to produce on barley is seen in the year of application, and not afterwards.

These conclusions are confirmed by the experiments with wheat on the Broadbalk field. Rape cake is applied in nearly double the quantity used on Hoos field: enough is given to supply 86 lb. of nitrogen per acre, and it has been applied since 1878. Adjoining is a plot receiving the same amount of nitrogen

TABLE III.—*Yield of Wheat on Broadbalk Field: Nitrogen obtained from various Sources.*

Source of Nitrogen.	Nitrogen Supplied per Acre. Lb.	Plot No.	Average for 20 Years, 1893-1912.		1917.†		1918.†	
			Grain. Bush. per Acre	Straw. wt. per Acre	Grain. Bush. per Acre	Straw. Cwt. per Acre	Grain. Bush. per Acre	Straw. Cwt. per Acre
Rape Cake (till 1916) ..	86	19	25.4	5.7	11.1	9.5	16.2	15.2
* Sulphate of Ammonia ..	86	17 & 18	28.8	3.7	23.0	17.1	19.7	24.6
* Nitrate of Soda ..	86	16	31.4	36.2	2.7	22.5	27.5	41.7
* N. Nitrogen ..	—	18 & 17	14.4	1.6	11.1	7.9	14.5	11.4

* Potash and phosphates supplied. † No rape cake given

in the form of sulphate of ammonia, along with superphosphate, potassium salts, etc. The results are given in Table III.

Thus again the nitrogen from rape cake is less effective than that from sulphate of ammonia and nitrate of soda (potash and phosphates being also supplied), and again it shows little or no permanent effect: the omission for a single year brings down the yield nearly to the level of the plot receiving no nitrogen. The total amount of rape cake applied to this plot during the course of the experiment exceeds 30 tons per acre, and it seems to have disappeared without leaving much trace.

When, however, we turn to the soil, evidence is found that the disappearance is not as complete as the crop results seem to indicate. There is an accumulation of nitrogen as shown in Table IV.

TABLE IV.—*Effect of Rape Cake on Nitrogen Content of Soils. Broadbalk Field (Wheat).*

Broadbalk Field	Plot.	Found in 1893.			Found in 1914.		
		Per Cent. in Surface Soil 0-9"	Subsoil 9-18"	Total lb. per Acre. 0-9"	Per Cent. in Surface Soil 0-9"	Subsoil 9-18"	Total lb. per Acre. 0-9"
Rape Cake supplied ..	19	·155	·079	3,480	·121	·055	3,290
Nitrogen as Sulphate of Ammonia ..	18	·123	·079	3,190	·106	·003	2,850
Nitrogen as Nitrate of Soda ..	17	·117	·078	3,040	·108	·074	3,010
Farmyard Manure ..	6	·118	·078	3,050	·103	·055	2,720
	2	·221	·077	5,151	—	—	—

Hoos Field (Barley).

Hoos Field.	Plot.	Found in 1868.			Found in 1882.			Found in 1914.		
		Per Cent. in Surface Soil 0-9"	Subsoil 9-18"	Total lb. per Acre. 0-9"	Per Cent. in Surface Soil 0-9"	Subsoil 9-18"	Total lb. per Acre. 0-9"	Per Cent. in Surface Soil 0-9"	Subsoil 9-18"	Total lb. per Acre. 0-9"
Rape Cake supplied ..	C 4	·137	·074	3,226	·131	·073	3,184	·120	·061	2,840
Nitrogen as Sulphate of Ammonia ..	AA 4	·121	·076	3,070	·106	·068	2,907	·101	·062	2,600
Nitrogen as Nitrate of Soda ..	A 4	·112	·080	2,840	·110	·077	2,770	—	—	—
No Nitrogen ..	O 4	·120	·075	3,040	·112	·084	2,940	·107	·068	2,750
Farmyard Manure ..	7-2	—	—	—	·213	·084	4,440	·262	·085	5,560

The accumulation is in both cases about 300-400 lb. per acre of nitrogen in excess of that on the adjoining plots receiving the same amount of nitrogen in the forms of nitrate of soda or sulphate of ammonia; it is nothing like as great as in the case of farmyard manure, but it is distinctly marked; yet it proved of no value to the wheat crop.

Mangolds.—These behave very differently from cereals, and show greater increases from rape cake than from corresponding amounts of artificial manures used alone. The results are shown in Table V.

TABLE V.—*Effect of Rape Cake on Yield of Mangolds.*
Tons per Acre.

Source of Nitrogen.	Nitrogen per Acre.	Series.	39 Years, 1876-1914.		1917.		1918.	
			Potash and Phosphates supplied. Plot 4.	No Potash supplied. Plot 5.	Potash and Phosphates supplied. Plot 4.	No Potash supplied. Plot 5.	Potash and Phosphates supplied. Plot 4.	No Potash supplied. Plot 5.
Rape Cake till 1916	98	C	22.1	10.8	19.1	9.9	16.9	12.5
Sulphate of Ammonia	86	A	14.8	7.0	19.2	6.8	22.4	12.5
Nitrate of Soda	86	N	17.7	15.0	17.9	15.0	28.6	25.2
No Nitrogen	—	O	5.0	5.0	3.9	3.3	4.6	5.7

A strict comparison of the values of rape cake and of sulphate of ammonia or nitrate of soda is impossible, because the rape cake is applied at the rate of 98 lb. of nitrogen per acre, while the others supply only 86 lb. The extra 12 lb. of nitrogen, however, can hardly by itself account for the greatly increased production as compared with sulphate of ammonia or even with that given by nitrate of soda.

It does not follow, however, that the result is due to any difference in value of the nitrogen. The yields from the artificial manures are very low in spite of the large amounts of plant food supplied. A farmer who gave his mangolds 12 or 13 cwt. per acre of good artificials, the quantity supplied in these experiments, would be greatly disappointed with a yield of only 15 or 17 tons per acre. It is obvious that neither the sulphate of ammonia nor the nitrate of soda is exerting its proper effect: some factor is interfering.

Inspection of the plots when the plant is young shows that there is a considerable loss of tilth where the artificials alone are used. The young plants have great difficulty in establishing themselves; they come up satisfactorily, but unless the weather is just sufficiently showery they make very little progress. Many of them die, gaps being frequent. Later on they move more quickly, but with the most careful transplanting it is often impossible to cover the plots completely. On the other hand, where rape cake is used there is less spoiling of the tilth and fewer losses and gaps. The numbers of plants at the end of the season are given in Table VI.

On the plots of the O series receiving neither sulphate of ammonia nor nitrate of soda the numbers for 14 years averaged 17 to 17½ thousand; the addition of rape cake somewhat improved matters and brought the number up to 18

TABLE VI.—*Barnfield Mangolds.*

Number of Plants per Acre.

Source of Nitrogen.	Series.	Average for 14 Years 1901-1914.		1917.*		1918.*	
		Potash and Phosphates supplied. Plot 4.	No Potash supplied. Plot 5.	Potash and Phosphates supplied. Plot 4.	No Potash supplied. Plot 5.	Potash and Phosphates supplied. Plot 4.	No Potash supplied. Plot 5.
Rape Cake till 1916. no Rape Cake since	C	18,013	18,323	11,667	10,542	18,010	17,700
Sulphate of Ammonia	A	16,542	14,894	11,393	8,008	17,492	19,002
Nitrate of Soda	N	16,646	15,726	10,601	10,887	19,677	18,598
No Nitrogen	O	17,548	16,942	10,954	10,464	16,152	15,659

* No Rape Cake supplied in these years.

thousand: sulphate of ammonia and nitrate of soda on the other hand caused a marked depression, reducing the numbers to 15 to 16½ thousand. It is not only a good effect of rape cake but a bad effect of sulphate of ammonia or nitrate of soda that is concerned.

On these plots also there is an important residual effect, as is shown in Table V. At first sight this seems inconsistent with the cereal results where no such effect appeared: there are, however, three important differences in conditions.

In the first place, the amount of rape cake applied is 2,000 lb. per acre. This large dressing is double that given to the barley plot: it has been applied every year beginning in 1861 with only one break, and, in addition, for an earlier period of the six seasons 1845 to 1850. Thus the total amount added has been 55 tons per acre; it would hardly be surprising, therefore, if there were a residual effect. The second difference lies in the amount of cultivation. The mangold field is cultivated right to the end of June and sometimes well into July, the wheat field only for a short period in October, and the barley field not later than March. It is possible, though reasons could be adduced against this view, that the extra cultivation of the mangold field induces more decomposition of the nitrogen compounds than goes on in the less cultivated wheat field with its mass of growing roots. The third difference is that the mangold leaves are ploughed in each year, whereas only

the stubble of the cereal crops is ploughed in. Where rape cake had been supplied the average weight of mangold leaves exceeded 3 tons per acre on the various plots; where there was no nitrogen the weight was only 1 ton per acre.

This third reason may well be the most important. On two previous occasions in the earlier years of the experiment the dressings of rape cake had been intermitted. In the years 1874 and 1875 no rape cake was given, although it had been applied regularly since 1861. The 1874 season was a bad one for mangolds; in no case was more than $14\frac{1}{2}$ tons per acre obtained; the plot that had previously received rape cake but now received nothing showed itself fully as good as the plots receiving manure. The 1875 season was better and the crops were higher; those on the plot that had previously received rape cake exceeded the others. It is probable that the ploughed-in leaves helped to bring this about because the plots which had formerly received sulphate of ammonia and nitrate of soda both showed apparent residual effects, and yet we know from the Broadbalk results that such residual effects are not normally obtained. The results are given in Table VII.

TABLE VII.—*Residual Effect of Rape Cake on the Growth of Mangolds. Tons per Acre.*

	Rape Cake		Nitrate of Soda		Sulphate of Ammonia.		No Nitrogen.	
	Potash and Phosphates supplied.	No Potash supplied.	Potash and Phosphates supplied.	No Potash supplied.	Potash and Phosphates supplied.	No Potash supplied.	Potash and Phosphates supplied.	No Potash supplied.
Wt. of Roots when Nitrogen was given (average of 3 ears 1871-3) ..	18.6	16.3	19.8	19.6	15.2	13.5	6.5	5.9
Wt. of Leaves ..	3.7	4.2	5.1	5.2	3.4	4.5	1.5	1.5
Wt. of Roots when Nitrogen was withheld { 1874	8.1	5.8	8.8	7.5	7.5	7.3	6.5	5.9
1875	10.1	11.1	9.4	9.9	7.8	7.8	5.4	5.5

From 1853 to 1855 the rape cake was left out after having been given to the turnip crop for four years; barley was then grown. The results show a distinct residual effect.

Rotation Experiments.—In all these experiments the conditions are somewhat abnormal; no farmer would ever use 2,000 lb. of rape cake—nearly 1 ton—each year on an acre of ground, nor would he grow the same crop on the same land year after year. An experiment on lines more like those of the ordinary farm is made in Little Hoos Field, where a rotation of crops is taken.

The quantities are still rather large, but not excessive—1,036 lb. per acre containing 50 lb. nitrogen. Five plots are used; four receive rape cake in turn once every four years, the fifth receives none. Thus in any one year there is a plot which has received its dressing in that year, another plot which had a dressing a year ago, a third two years ago, and a fourth three years ago. The yields are given in Tables VIII. and IX.

TABLE VIII.—*Effect of Rape Cake, Guano, and Shoddy on Yield of Crops in Little Hoos Field, Rothamsted.*

Total Produce, Grain and Straw, or Roots and Leaves, per Acre.

Series and Plots.	Manuring.	Swedes, 1904.	Barley, 1905.	Man-golds, 1906.	Spring Wheat, 1907.	Swedes, 1908.	Barley, 1909.	Wheat, 1910.	Man-golds, 1911.	* Wheat, 1912.
		Tons.	Lb.	Tons.	Lb.	Tons.	Lb.	Tons.	Lb.	Bush.
A 1	Unmanured ..	10.3	2,323	17.1	3,650	14.0	3,792	2,270	11.6	19.4
2	Dung, Ordinary (1904, '8 & '12)	13.1	4,649	18.2	4,673	13.1	5,128	2,572	13.9	24.8
3	Dung, Ordinary (1905 & '9)	8.8	3,501	17.5	5,333	14.5	5,544	2,681	14.1	26.9
4	Dung, Ordinary (1906 & '10)	8.8	2,269	18.2	5,471	15.	4,057	2,406	12.5	29.2
5	Dung, Ordinary (1907 & '11)	9.8	2,402	14.1	6,903	17.3	4,511	2,358	15.8	26.8
B 1	Dung, Cake-fed (1904, '8 & '12)	15.7	4,177	19.4	4,319	22.4	5,362	2,386	14.1	35.6
2	Unmanured ..	10.0	2,417	16.2	4,025	14.3	3,862	2,261	12.0	21.8
3	Dung, Cake-fed (1905 & '9)	9.5	5,530	18.5	5,497	14.2	6,841	2,921	14.2	29.4
4	Dung, Cake-fed (1906 & '10)	11.4	2,772	25.6	6,489	16.9	4,110	3,502	14.4	26.5
5	Dung, Cake-fed (1907 & '11)	9.4	2,615	11.4	9,407	19.0	4,298	2,169	17.1	31.4
C 1	Shoddy (1904, '8 & '12)	14.7	3,656	21.0	4,667	19.7	3,960	2,295	11.4	28.4
2	Shoddy ..	11.1	4,383	23.6	4,552	16.3	4,558	2,387	11.6	26.1
3	Unmanured ..	10.5	2,583	17.7	4,331	15.1	3,850	2,561	11.7	24.2
4	Shoddy (1906 & '10)	10.7	2,512	24.2	6,231	11.1	4,466	3,461	14.0	30.4
5	Shoddy (1907 & '11)	10.3	2,615	16.9	7,495	22.2	5,448	2,560	14.7	29.8
D 1	Guano (1904, '8 & '12)	11.6	2,550	20.1	4,056	20.9	3,608	1,742	10.5	28.8
2	Guano (1905 & '9)	11.0	6,178	19.7	4,165	15.3	6,834	2,114	11.1	24.1
3	Guano (1906 & '10)	10.9	2,857	25.6	4,846	15.9	4,053	3,392	11.1	22.5
4	Unmanured ..	10.0	2,985	18.7	4,618	17.4	4,510	2,739	11.8	26.9
5	Guano (1907 & '11)	10.5	2,680	17.4	7,375	15.7	4,014	2,374	14.2	26.3
E 1	Rape Cake (1904, '8 & '12)	14.1	2,674	17.8	3,887	19.7	3,750	2,180	10.7	27.7
2	Rape Cake (1905 & '9)	11.2	4,185	17.0	4,326	15.1	5,203	2,242	11.7	22.3
3	Rape Cake (1906 & '10)	9.0	2,645	22.7	4,584	14.5	3,866	3,485	11.5	21.2
4	Rape Cake (1907 & '11)	11.5	2,734	19.4	6,619	15.2	4,661	2,516	14.5	25.1
5	Unmanured ..	10.3	2,769	19.5	4,527	14.7	4,155	2,784	12.7	21.1
F 1	Unmanured ..	11.7	2,132	22.9	4,749	14.1	4,814	3,166	8.7	31.6
2	Superphosphate (1904, '8 & '12)	13.2	3,025	23.2	5,164	16.9	4,726	3,223	10.9	33.4
3	Superphosphate (1905 & '9)	10.2	3,940	23.5	4,956	14.6	4,973	2,922	11.7	31.9
4	Superphosphate (1906 & '10)	9.7	3,923	24.1	5,419	16.0	5,280	2,682	12.3	34.9
5	Superphosphate (1907 & '11)	9.7	4,221	23.6	5,688	16.4	5,641	3,190	14.2	35.4

(Continued overleaf.)

Series and Plots.	Manuring.	Swedes, 1904.	Barley, 1905.	Man-golds, 1906.	Spring Wheat, 1907.	Swedes, 1908.	Barley, 1909.	Wheat, 1910.	Man-golds, 1911.	* Wheat, 1912.
G 1	Bone Meal (1904, '8 & '12)	Tons. 12.9	Lb. 3,176	Tons. 23.1	Lb. 5,203	Tons. 16.7	Lb. 4,445	Lb. 3,345	Tons. 9.9	Bush. 32.8
2	Bone Meal (1905 & '9).	10.1	3 638	22.1	5,821	14.3	4,922	3,657	9.9	32.7
3	Unmanured ..	10.2	3,495	20.6	5,491	12.7	4,247	3,701	9.2	29.0
4	Bone Meal (1906 & '10).	9.9	3,450	22.6	6,043	14.2	4,711	3,283	10.5	31.8
5	Bone Meal (1907 & '11).	9.2	3,525	22.1	6,276	19.9	5,285	3,512	12.6	34.4
H 1	Basic Slag (1904, '8 & '12)	11.8	4,400	20.5	6,285	12.8	4,182	3,564	11.5	35.7
2	Basic Slag (1905 & '9).	10.4	4,002	21.3	5,930	13.6	4,530	3,596	12.7	33.7
3	Basic Slag (1906 & '10);	9.4	3,662	21.4	5,860	13.6	4,431	3,943	12.5	29.1
4	Basic Slag (1907 & '11).	9.1	3,624	17.0	5,818	14.4	3,860	3,804	12.0	32.5
	Unmanured ..	8.6	3,293	17.4	5,933	11.4	4,511	4,005	10.5	30.1

* Dressed Grain only.

The yields on the plots to which the manure was applied in any given year are printed in heavier type.

TABLE IX.—Effect of Guano in Year of Application and in Subsequent Years. Little Hoos Field, Rothamsted.

(Unmanured=100.)

Peruvian Guano.	Swedes, 1904.	Barley, 1905.	Man-golds, 1906.	Wheat, 1907.	Swedes, 1908.	Barley, 1909.	Wheat, 1910.
Unmanured	100	100	100	100	100	100	100
Year of application	135	182	142	160	120	152	124
1st year after application ..	—	90	109	105	90	80	77
2nd year after application ..	—	—	112	90	91	89	64
3rd year after application ..	—	—	—	88	88	90	87

Peruvian Guano.	Man-golds, 1911.	Wheat, 1912.	Swedes, 1913.	Barley, 1914.	Man-golds, 1915.	Wheat, 1916.	Mean, 1904-16.
Unmanured	100	100	100	100	100	100	100
Year of application	120	107	164	180	125	139	142
1st year after application ..	94	98	115	92	106	86	95
2nd year after application ..	97	84	103	70	106	90	91
3rd year after application ..	89	90	113	81	73	95	89

Effect of Rape Cake in Year of Application and in Subsequent Years. Little Hoos Field, Rothamsted.

(Unmanured=100.)

Rape Cake.	Swedes, 1904.	Barley, 1905.	Man-golds, 1906.	Wheat, 1907.	Swedes, 1908.	Barley, 1909.	Wheat, 1910.
Unmanured	100	100	100	100	100	100	100
Year of application	134	151	116	146	134	125	125
1st year after application ..	—	98	92	101	103	90	81
2nd year after application ..	—	—	91	96	99	112	78
3rd year after application ..	—	—	—	86	103	93	90

Rape Cake.	Mangolds, 1911.	Wheat, 1912.	Swedes, 1913.	Barley, 1914.	Mangolds, 1915.	Wheat, 1916.	Mean, 1904-16.
Unmanured	100	100	100	100	100	100	100
Year of application	114	131	78	181	185	143	136
1st year after application	91	119	115	153	159	118	110
2nd year after application	92	105	100	101	156	132	106
3rd year after application	84	106	96	118	113	133	102

Effect of Shoddy in Year of Application and in Subsequent Years. Little Hoos Field, Rothamsted.

(Unmanured=100.)

Shoddy.	Swedes, 1904.	Barley, 1905.	Mangolds, 1906.	Wheat, 1907.	Swedes, 1908.	Barley, 1909.	Wheat, 1910.
Unmanured	100	100	100	100	100	100	100
Year of application	137	170	110	173	110	118	135
1st year after application	—	142	116	144	147	113	93
2nd year after application	—	—	121	105	126	142	90
3rd year after application	—	—	—	108	108	116	100

Shoddy.	Mangolds, 1911.	Wheat, 1912.	Swedes, 1913.	Barley, 1914.	Mangolds, 1915.	Wheat, 1916.	Mean, 1904-16.
Unmanured	100	100	100	100	100	100	100
Year of application	120	117	135	161	124	106	136
1st year after application	121	123	119	99	109	116	121
2nd year after application	99	121	91	87	93	111	108
3rd year after application	99	108	71	115	77	8	98

The results show that rape cake was distinctly effective in its year of application, but not afterwards, in the first seven years of the experiment. From the eighth year onwards, *i.e.*, after the third dressing, there is something to show in the second year, and this was particularly the case for the barley crop in 1914. In 1915 the figures are less significant than they look because the mangold crop was a virtual failure, the highest yield being only 8 tons 14 cwt. per acre. On the whole the results confirm the conclusions already drawn from the wheat and barley experiments, that rape cake produces little appreciable effect after the first year of application. Another experiment on the same field enables the effect of rape cake to be compared somewhat roughly with that of sulphate of ammonia. The plots of Series F, G and H, on the same field receive 1 cwt. sulphate of ammonia each year. Series F adjoins the rape cake plots: four of its component plots receive superphosphate in the same way as the rape cake is supplied. Although this series only receives 22 lb. of

nitrogen, *i.e.*, somewhat less than half that given on the rape cake plots, the yield when superphosphate is supplied is not much inferior.

TABLE X.—*Returns from Rape Cake and from Sulphate of Ammonia.*

	Swedes, 1904.	Barley, 1905	Man- golds, 1906.	Spring Wheat, 1907.	Swedes, 1908.	Barley, 1909.
	Tons.	Lb.	Tons.	Lb.	Tons.	Lb.
50 lb. Nitrogen as Rape Cake	14.1	4,185	22.7	6,619	19.7	5,203
22 lb. Nitrogen as Sulphate of Ammonia plus Superphosphate	12.2	3,949	24.1	5,698	16.9	4,973
22 lb. Nitrogen as Sulphate of Ammonia (1 cwt. per acre), no Superphosphate	11.7	3,132	22.9	4,749	14.1	4,814
No Manure	10.8	2,769	19.5	4,527	14.7	4,155

	Wheat, 1910.	Man- golds, 1911.	Wheat, 1912.	Swedes, 1913.	Barley, 1914.	Wheat, 1916.
	Lb.	Tons.	Bush.	Tons.	Bush.	Bush.
50 lb. Nitrogen as Rape Cake	3,486	14.5	27.7	5.5	6.0	18.4
22 lb. Nitrogen as Sulphate of Ammonia plus Superphosphate	2,682	14.2	33.4	8.6	37.3	19.9
22 lb. Nitrogen as Sulphate of Ammonia (1 cwt. per acre), no Superphosphate	3,166	8.7	31.6	6.4	23.3	11.7
No Manure	2,784	12.7	21.1	7.0	19.3	10.1

During twelve seasons the rape cake, in spite of its double quantity of nitrogen, has only on six occasions proved better than sulphate of ammonia and superphosphate, the crops being swedes 1904 and 1908, barley 1905 and 1909, wheat 1907 and 1910. In the other years the sulphate of ammonia and superphosphate came out as well as the rape cake, and sometimes rather better. The crops, however, were not heavy; in some cases they were poor; they were:—swedes 1913 (a poor crop), mangolds 1911 (a poor crop), wheat 1912 (a fair crop) and 1916 (a poor crop), barley 1914.

Thus, although the experiment is not specially designed to test this point, the result is quite consistent with the conclusion drawn from the Hoos field and Broadbalk plots that the nitrogen in rape cake is not superior to the nitrogen in sulphate of ammonia or nitrate of soda.

Other experiments on rape cake have been made in various parts of the country, especially on light soils where it is supposed to have a particular value. The most important of these have been at the Royal Agricultural Society's Station at Woburn, on a light sandy loam. The application of rape cake began in 1890 and has been continued ever since; the crops grown are wheat and barley. In the earlier years the rape cake, sulphate of ammonia and nitrate of soda were each applied at a rate

equivalent to 100 lb. per acre of ammonia; since 1907, however, the rate of application has been reduced and now is equivalent to 25 lb. ammonia per acre. The results are given in Table XI.

TABLE XI.—*Yields of Wheat and Barley at Woburn. Nitrogen from different Sources.*

	Continuous Wheat, Bush. per Acre.		Continuous Barley, Bush. per Acre.	
	100 lb. Ammonia, 1896-1905.	25 lb. Ammonia, 1907-1916.	100 lb. Ammonia, 1896-1905.	25 lb. Ammonia, 1907-1916.
Rape Cake	25.6	18.6	28.6	17.4
Nitrate of Soda and Minerals	28.3	17.5	36.8	18.6
Nitrate of Soda alone	—	15.2	30.9	13.7
Farmyard Manure	24.5*	—	32.5*	—
No Manure	8.4	9.4	11.0	10.0

* Equivalent to 200 lb. ammonia per acre.

In no case is the rape cake superior to the mixture of nitrate of soda and minerals, and in the earlier years where larger dressings were used it was inferior. It has proved, however, quite equal to farmyard manure, even when this is used in quantities containing double its amount of nitrogen.

Another series, less extensive in point of time, but under rotation conditions actually obtaining in farm practice, was made by the Norfolk Chamber of Agriculture during the years 1889-1891. On an average 4 cwt. of rape cake had substantially the same effect on the wheat crop as 1 cwt. sulphate of ammonia which would contain approximately the same amount of nitrogen; while 8 cwt. had no better result. Increasing the amount of nitrogen at these centres not only caused no increase but tended to a decrease in crop. Farmyard manure on the other hand cause a marked increase in crop. Thus if no limiting factor were operating it appears that the nitrogen from rape cake is no better than that from sulphate of ammonia, while if there were a limiting factor rape cake was less effective in putting it out of action than farmyard manure. The yields of wheat at the three centres Cawston, Bolwick and Flitcham* were during the three years 1889-1891—

	Bush. per acre.
Rape Cake, 4 cwt.	27.8
Sulphate of Ammonia, 1 cwt.	27.6
Rape Cake, 8 cwt.	27.5
No Manure	24.9

A further set of experiments under conditions of actual farming has been made at Bramford, in East Suffolk, on a

* Norfolk Chamber of Agriculture Reports, 1889-1891.

light sandy soil. Unfortunately, the quantities are not applied on an equivalent basis, so that no strict comparison is possible; the rape cake supplied rather more nitrogen than the nitrate of soda but only half that of farmyard manure. The results are given in Table XII.*

TABLE XII.—*Effect of Rape Cake and other Manures at Bramford. Average Yields for 5 Years.*

—	Approximate Amount of Nitrogen supplied.	Barley. Bush. per Acre.	Wheat. Bush. per Acre.	Mangolds. Tons per Acre.	Clover Hay (2 years (1903-4). Cwt. per Acre.	Peas (1904-5). Lush. per Acre.
Rape Cake, 8 cwt. per acre ..	44 lb.	37½	22	13.9	30	25½
Farmyard Manure, 6 tons per acre	90 „	37½	20	15.9	33	27
Nitrate of Soda, 2 cwt. per acre ..	35 „	35	21	15.4	28	23½
No Manure	—	26	19	11.8	29	23½

In these cases also the rape cake has proved little better than nitrate of soda, but again there may have been a limiting factor at work which the rape cake could not throw out of action. None of the experiments, however, give any reason to suppose that rape cake is of special value on light soils.

Another comparison was made in the early days in Yorkshire by the Leeds University Department of Agriculture. In one experiment at Garforth on potatoes the quantities of nitrogen are comparable, and here the rape cake proved inferior to the sulphate of ammonia. In the other cases no comparison is possible.

The results were† :—

TABLE XIII.—*Effect of Rape Cake and other Manures in Yorkshire.*

—	Potatoes at Garforth.		Potatoes at County Centres.		Swedes.		Mangolds.	
	Dressing.*	Yield. Tons per Acre.	Dressing.†	Yield. Tons per Acre.	Dressing.‡	Yield. Tons per Acre.	Dressing.§	Yield. Tons per Acre.
Rape Cake ..	660 lb.	7.3	5 cwt.	8.9	8 cwt.	15.4	10 cwt.	24.6
Sulphate of Ammonia	168 lb.	8.2	—	—	—	—	—	—
Farmyard Manure	—	—	5 tons	10.7	5 tons	15.7	10 tons	26.4

* Both contained approximately 33 lb. nitrogen. In addition superphosphate and sulphate of potash were given.

† Rape cake contained approximately 28 lb. nitrogen and farmyard manure, probably 65 lb. In addition 5½ cwt. of a mixture of artificials were given, including 1 cwt. nitrate of soda.

‡ Rape cake contained approximately 44 lb. nitrogen and farmyard manure 75 lb. In addition 9 cwt. mixed artificials were given.

§ In addition 7 cwt. of a mixture of artificials—2 cwt. nitrate of soda, 2 cwt. superphosphate, 3 cwt. sulphate of potash were given.

* Bramford and Saxmundham Report, Cambridge University, 1907, p. 144, *et seq.*

† Leeds Bulletin No. 3, 1898.

One experiment is recorded with hay, at Cirencester, but the quantities are not comparable and nothing can be gathered from the results* :—

TABLE XIV.—*Effect of Rape Cake and other Manures on Hay.*

—	Probable Amount of Nitrogen. Lb. per Acre.	Yield of Hay. Cwt. per Acre.
Rape Cake, 5 cwt.	28	24½
Sulphate of Ammonia, 2 cwt. ..	44	28½
Farmyard Manure, 12 tons ..	160	38½
No Manure	—	19½

An experiment in Cornwall on mangolds and one at Wye on barley are recorded ; but again no comparison can be made with nitrate of soda or sulphate of ammonia, as unequal amounts of nitrogen are involved.

TABLE XV.—*Effect of Rape Cake and other Manures on Mangolds and Barley.*

—	†Cornwall : Mangolds.		‡Wye : Barley.	
	Dressing Used.	Yield per Acre.	Dressing Used.	Yield per Acre.
	Cwt.	Tons.	Cwt.	Bush.
Rape Cake	2	40·8	1	29
Nitrate of Soda	2	42·6	—	—
Sulphate of Ammonia	—	—	½	26
No Nitrogenous Manure..	—	39·2	—	—

Comparisons can better be made in another series of Wye experiments recorded in the same Journal (pp. 40–42)

TABLE XVI.—*Effect of Rape Cake and Sulphate of Ammonia in Kent.*

—	Approximate Amount of Nitrogen per Acre.	Lenham.	Sturry.
Rape Cake, 3 cwt. per acre ..	17	36½	21½
Sulphate of Ammonia, 1 cwt. per acre	22	30½	25½

* Royal Agricultural College, Cirencester, Sci. Bull. No. 3, 1911.

† Cornwall Report, 1911, p. 83. 2 cwt. kainit added in each case.

‡ Wye College Journal, No. 6, 1897, p. 41. 2 cwt. superphosphate given in each case.

½ 1½ cwt. superphosphate.

½ 2 cwt. superphosphate.

These experiments teach us nothing about the length of time the rape cake will last, but they show no superiority of rape cake nitrogen over sulphate of ammonia or nitrate of soda nitrogen. Again, however, they are consistent with the view that rape cake is safer for a man not expert in the use of artificials; for in these experiments the test mixture of nitrate of soda or sulphate of ammonia with potash and phosphates was an attempt by skilled people to supply the best adapted to the conditions; unskilled men might easily have gone wrong.

GUANO.—Another series of experiments on Little Hoes Field at Rothamsted has been devoted to guano. A good Peruvian guano is used, averaging 6·5 per cent. of nitrogen; 777 lb. is applied (*i.e.*, nearly 7 cwt. per acre), so as to give 50 lb. nitrogen per acre.

As in the case of rape cake a good effect is produced in the first year but not subsequently; nothing at all can be seen in the second, third or fourth years. Thus there is even less sign of a residual effect than in the case of rape cake. On the whole, however, the crops are superior to those grown with rape cake, indicating that the constituents of guano are somewhat more effective. (See Tables VIII. and IX.)

Very few other experiments seem to be recorded with guano. The Norfolk Chamber of Agriculture tried a high class guano containing nitrogen equivalent to 10 per cent. of ammonia on barley, but found 1½ cwt. per acre to be less effective than 1 cwt. of nitrate of soda and of course more expensive. The quantities of nitrogen were not equivalent, however, the guano only supplying 13 lb. per acre, while the nitrate of soda supplied 17 lb.

In the experiments on swedes an attempt was made to furnish equal quantities of nitrogen, potash and phosphates in the two dressings. The results were:—

TABLE XVII.—*Effect of Guano and other Manures on Swedes and Barley.*

—	Swedes. Tons per Acre.	Barley. Bush. per Acre.	
		Cawston, Flitcham, 1887-90.	Bolwick, 1888-89.
Guano, 1½ cwt. per acre	13·6	31·7	44·1
Sulphate of Ammonia	13·3	—	—
Nitrate of Soda, 1 cwt. per acre ..	—	35·6*	50·3†

* 2 cwt. superphosphate also added.*

† 1½ cwt. nitrate of soda used here; 2 cwt. superphosphate added

In the swede experiments the guano plot also received $\frac{1}{2}$ cwt. sulphate of ammonia and $\frac{3}{4}$ cwt. muriate of potash, and the sulphate of ammonia plot received 4 cwt. superphosphate and 1 cwt. muriate of potash.

At Cirencester one of the hay plots received guano at the rate of 5 cwt. per acre and it yielded $23\frac{1}{2}$ cwt. of hay, this being below that obtained for 2 cwt. sulphate of ammonia (see p. 243).

SHODDY.—The material used contained just over 5 per cent. of nitrogen. One ton per acre was applied for the first four years (1904 to 1907), but only 957 lb. per acre in 1908 and since; this quantity contains 50 lb. of nitrogen; the larger quantity contained 112 lb. of nitrogen. The larger dressings left a distinct residue which produced a marked effect in the second or even the third year. The smaller dressings showed residual effect only in four out of the eight years, viz., in 1911, 1912, 1913 and 1916.

The results with shoddy are given in Tables VIII and IX.

COMPARISON OF RAPE CAKE, GUANO AND SHODDY.—When the average yields from these three for the whole period are taken out it is seen that there is little difference between them. The results are :—

TABLE XVIII.—*Relative Effects of Rape Cake, Guano and Shoddy.*

—	When Un-manured Plot=100.	When 4th-year Plot=100.		
		Year of Application	Residual Effect.	Total Effect.
Peruvian Guano, all years	142	159	Nil	159
" " 1908-1916	137	152	Nil	152
Rape Cake, all years ..	136	133	10	143
" " 1908-1916	135	130	9	139
Shoddy, all years ..	136	134	29	163
" " 1908-1916	128	132	27	159

It may, therefore, reasonably be assumed that the conclusions drawn from the rape cake trials will hold equally good for guano and shoddy.

It is possible that the figure for the Peruvian guano is low. If the plots of the third and fourth years are taken as the basis (and they equally well could be), the guano comes out distinctly higher than the rape cake or shoddy in the year of application; if, however, account is taken of residual effects it loses its superiority.

The figures for shoddy "all years" are on the high side, because, as already pointed out for the first four years, it was applied in larger amounts. Confining attention to the years 1908-16 where the amounts have been comparable, shoddy is less effective than guano, but it has a more distinct residual effect.

CONCLUSIONS.—When Peruvian guano, rape cake and shoddy are compared on the basis of equal amounts of nitrogen per acre—

Peruvian guano proved the most effective, especially in the year of application.

Rape cake came next.

Shoddy* by a small margin came last in its year of application.

Numerically the values were :—

Peruvian guano	..	..	..	100
Rape cake	..	..	..	91
Shoddy	..	..	..	88

Shoddy showed a residual effect which would improve its position.

The differences are less than might have been expected. No evidence could be obtained that the nitrogen in rape cake is superior in crop-producing power to the nitrogen of sulphate of ammonia or nitrate of soda. No larger crops were obtained from rape cake than from an equivalent dressing of sulphate of ammonia and superphosphate, and actually less was obtained than from nitrate of soda.

There is very little evidence for the view that rape cake and Peruvian guano permanently benefit the soil. Where very large dressings of rape cake (10 cwt. to 1 ton per acre) are applied year after year to the same land there is in course of time an accumulation of nitrogen, but this proves of little value to wheat or barley; on the other hand, it may be more useful to mangolds, though the evidence is not conclusive.

In ordinary farm practice where smaller dressings are given and less frequently than every year, there is little reason to anticipate any residual effect.

If this were the whole case there would be no reason why rape cake and guano should ever sell at prices above those obtaining for sulphate of ammonia and nitrate of soda. Yet farmers and manure makers have always been willing to pay more. There appear to be three reasons for this preference. Rape cake and guano are safer than artificial manures in the hands of inexperienced cultivators. No one would be likely to apply too much, owing to high prices, and there is no necessity to mix with other fertilisers.

Further, from the manure makers' point of view, these substances have the enormous advantage of improving the condition of compound fertilisers, a property to which farmers rightly attach great importance in view of the widespread use of manure drills.

Lastly, from the special point of view of the horticulturist who uses in the aggregate large quantities of manure, rape cake and guano have the advantage that they can be applied once for all, whilst artificials would have to be given in several small doses, otherwise they might injure the plant or the soil.

While these three reasons may account for the higher prices rape cake and guano always command in comparison with nitrate of soda or sulphate of ammonia, they do not help to suggest a fair price; obviously additional value cannot be assessed on the ordinary unit system. It has been suggested that a unit value should be allowed for organic matter, but this would not meet the case, as the organic matter is not usually applied to the soil in sufficient quantity to exert any appreciable effect. Probably the best solution is to leave prices to settle themselves between buyer and seller.

ORGANISATION OF THE VILLAGE.

THE following is a résumé of a Paper read before the Agricultural Club, on 9th April, by Sir Douglas Newton, K.B.E.

The Land Settlement (Facilities) Bill contains many important provisions. Among these provisions are measures for the acquisition of land for the purposes of small holdings, reclamation and drainage; and others which amend enactments relating to small holdings and allotments, and otherwise facilitate land settlement. The Bill contains also one little sub-clause which may well exercise great and far-reaching influence on the development and advancement of village communal life. This provision, if efficiently and energetically administered, may indeed go far towards re-establishing the true economic balance between rural and urban interests. It sets up and defines the powers of the new County Agricultural Committees, and enacts that: "The County Agricultural Committee shall make such inquiries as appear to them to be desirable, with a view to formulating schemes for the development of rural industries and social life in rural places, and for the co-ordination of action by Local Authorities, and

other bodies, by which such developments may be effected, and shall report the result of such inquiries to the Board of Agriculture and Fisheries, and to any Local Authority, or body, concerned; and the expenses incurred by the Committee under this section to such amount as may be sanctioned by the Board, with the approval of the Treasury, shall be defrayed by the Board." This clause may, and probably will, if wisely and sympathetically administered, prove the foundation upon which can be built a helpful, constructive, and permanent policy of rural development.

If rapid progress is to be made with the organisation of village life, if our system of land settlement is to be a happy reality, it will be necessary to see that Agricultural Committees take active steps to ascertain the needs of their localities, and to formulate well-considered schemes for the development of the amenities of life in the rural areas under their supervision and control.

Assuming, however, that the inertia has been overcome, and that this difficulty has been surmounted, and action is to be taken, the real and pertinent question will then be what practical steps should be taken, and what machinery it is necessary to provide. I am not a believer in relying altogether on voluntary work. Voluntary work, if it is to be effective, and if real progress is to be made, must always have behind it the services of full-time salaried officers. In most cases the happiest combination for many purposes is to be found by setting up an organised body, prepared and willing to give its services voluntarily in an advisory capacity—promoting and assisting in carrying out any scheme, but relying for the actual detailed work upon the services of whole-time salaried officers.

The problem may be said, briefly, to divide itself under two heads: on the one side there is the question of the social development of village life, and on the other the question of the economic development of the rural community. Reduced to practical terms this may be said to cover all branches of village life—from the construction and management of village halls to the organisation of seasonal and part-time occupations, and the provision of alternative sources of employment by which the income of the rural dweller may be augmented.

Proposals of the Agricultural Policy Sub-Committee.—The Report of the Agricultural Policy Sub-Committee put forward certain suggestions and recommendations which they were of opinion would, if carried out, provide for a suitable system of village

organisation. I would like briefly to summarise their suggestions, because I feel that they do not by any means represent the best lines along which the problem should be approached. The Committee proposed :—

1. That a general survey of the conditions of agriculture should be made by the War Executive Committees, to form the basis of a report to the Board of Agriculture in all cases where these surveys disclosed the need of action to improve the conditions of village life.
2. That the report should be referred to the Agricultural Committee and to the Parish Council of the village concerned, in order that these bodies might give it their consideration and concur in its recommendations.
3. That in the event of the concurrence of these bodies, or in the case of an application being received by the Board from either of these local authorities, the Board should appoint a valuer to prepare a report as to the most practical way of improving conditions in the parish in respect of small occupying owner-ships, allotments, small holdings, cottage gardens, parish recreation grounds, and the provision of a village hall.
4. That the valuer's report should then be communicated by the Board to the local authority, and be open for inspection by all interested persons.
5. That the Board should then send down an inspector to hold a local inquiry to deal with all objections which might be raised.
6. That an approved and final scheme setting forth in detail the changes proposed, scheduling any land required to carry out the scheme, should then be submitted to the Board. It was also suggested that in all cases the details should receive the approval of the Agricultural Committee.
7. That the responsibility for carrying out the scheme should then rest with the County Agricultural Committee.
8. The subsequent responsibility for its administration should lie with the Parish Council, subject only to the general supervision of the Agricultural Committee ; or, alternatively,
9. That a public Utility Society should be entrusted with the duty of carrying the scheme into effect.

So far as the expenses were concerned the Report suggested that the preliminary expenditure incurred in connection with the valuer's fees, and the local inquiry, should be defrayed by the Board of Agriculture out of public funds ; that the cost of acquiring and adapting land should be advanced from the same source, and be repaid in instalments by the Parish Council, which should, except in so far as certain public improvements were concerned, recoup itself from the parties directly benefited ; and that it would probably be found advisable to limit the annual charge on the rates to a sum not exceeding 6*d.* in the *£*.

Objections to the Proposal.—I do not wish to urge anything against the principles on which the Committee have based

these proposals, for as a rural dweller I believe them to be entirely sound; but I do feel that the machinery proposed would in practice prove inactive and slow working, and would probably in a short time clog up altogether.

Alternative Proposals.—Some alternative proposals must be considered, proposals which should be smoother in their working and more rapid in their action.

The problem of village organisation should be divided up into matters which may be considered to be "essentials," and which must be regarded as the minimum requirements of every village, and into those matters which, while they cannot be regarded as being absolute essentials, should yet be looked upon as being highly desirable of attainment. I suggest that the Board of Agriculture should be requested, as soon as the Land Settlement (Facilities) Bill has become law, to prepare a short statement indicating the general lines along which village organisation should be undertaken, and in particular emphasising the essential provisions which should be regarded as a minimum of requirement for every village in which they can be provided. The Board's statement should also have issued with it a model form of *questionnaire*, a form which could be used as the basis upon which any particular scheme of organisation could be built. The statement and form of questions would necessarily have to be very carefully prepared, and should, when prepared, be transmitted officially to the Chairman of every County Agricultural Committee with an instruction to him to obtain and furnish to the Board, within a limited and stated period, a full report on every rural parish situated within the Agricultural Committee's administrative area. The Report should show the requirements of each parish and its lack, or otherwise, of the essential provisions indicated in the *questionnaire*. Due regard will, of course, naturally have to be paid to any special circumstances applying to a particular village when the report is being prepared, and a certain degree of intelligence will have to be shown, and a certain measure of elasticity necessarily provided for.

It is suggested that the Report should be made a definite obligation upon every County Agricultural Committee. I venture to put forward this suggestion because, having served on Parish Councils, Rural District Councils, and County Councils, it has been brought home to me that in many cases the lack of village organisation is due not so much to the absence of necessary legislative powers, as to a short-sighted spirit of parsimony, and to a soulless inertia which is, alas, frequently

a latent characteristic of the personnel of the smaller local authorities. If any general and successful measure for the reconstruction of village life is to be undertaken, a broad and practical policy must be adopted, and attention paid to matters upon which the spirit of communal life depends.

The broadening out of village life would not only add greatly to its amenities, but at the same time would disclose matters which, if they remain undealt with, would often tend seriously to affect the future life and welfare of the community concerned.

So soon as the Report has been received by the County Agricultural Committee, and if it shows the need for improvement and organisation in a parish, a representative of the local authority should be required to make a further and more detailed investigation with a view to ascertaining the most practical method of bringing about the improvements desired. It is at this stage that the officer should take steps to get into touch with all persons and agencies able to assist with the organisation of the parish. People will often, even usually, help in any work for the general welfare, provided that they clearly see the need for what is proposed. The work of getting into touch should be undertaken by a whole-time salaried officer, who would find plenty of scope for his time and activities. To meet the case of a County Agricultural Committee, which, for any reason, was unwilling to act progressively and to take a big view of its responsibilities, it would be desirable that the Board of Agriculture should indicate its intention of promoting schemes, if necessary, and acting in default in all cases where this appeared to be desirable.

As soon as the local information and offers of assistance have been obtained, the next step should be to make an appeal for voluntary funds and assistance. This appeal should be made by the committee and its officer, who should also take steps in an unofficial way to interest themselves in the needs of the particular parish, and to assist it with the organisation of any entertainments required to enable it to obtain funds from the public for the promotion of the objects in view. Any general funds received should be vested in the hands of trustees. It not infrequently occurs that a village community hardly itself realises its own needs and requirements until these have been pointed out to it by some outside body. Organisation, and particularly central organisation, is lacking, and until organisation is developed, the true advantages, and they are many, of village life will never be made fully available.

Work of the County Agricultural Committee.—The County Agricultural Committee should, in addition to taking steps already indicated for obtaining money from voluntary sources, also, if necessary, be required to raise loans for such services as are properly chargeable on the rates, and the charges in connection with these loans should be allocated in due proportion to the parish or parishes benefited.

The authority should at the same time make a grant towards any other improvements which appear to them to be essential, in all cases in which voluntary assistance proved inadequate to provide them. The unit of any scheme should, I think, be not less than one parish, but should, if thought desirable, also embrace adjacent parishes.

The reconstruction scheme for the village having thus been approved by the County Agricultural Committee, and by the Board of Agriculture, the committee should be made responsible for carrying out the scheme. The committee should, however, have power to delegate the administration of the scheme, in so far as might appear to them to be suitable in any particular case, to the authorities of the parish in respect of which the scheme had been framed.

Reference has already been made to the need of uniformity in the nature and form of the inquiry to be instituted; and the desirability of so dividing the form of inquiry as to bring into special prominence the conditions which may be considered as essential ones, whilst also including those, which, if not essential, would yet be of a highly desirable character.

Essential Requirements.—It is a difficult matter to summarise the provisions which are to be regarded as essential for the amenities of every rural parish, but they should, I think, include—

(a) **COTTAGE GARDENS.**—The provision of a number of sanitary and suitable cottages with gardens attached, adequate to meet the requirements of the parish.

It is frequently found that gardens have not been provided, even in cases where this could, with but little disturbance or difficulty, have been done.

In a general way it will be found more economic and equally satisfactory to the householder to attach a small, rather than a large, garden to his cottage. If this be done, however, it is desirable that a strip of land should, if possible, be provided immediately behind the cottage gardens, and divided up for the general use of all or any of the cottagers desiring such

additional land. This plan is in many respects preferable to having a large garden attached to every cottage, as in the event of one of the cottagers not requiring his garden the land is apt to be left derelict, while if a small garden only be attached this risk is greatly minimised. Moreover, if access to additional land be provided in this manner, an energetic householder can, if he so desires, be provided with a larger area to cultivate.

(b) MILK.—The provision of an adequate supply of milk must be looked upon as an absolute essential. Farmers who are milk producers object to being at one and the same time small retailers and large wholesalers, with the result that often little or no milk is available for local residents in the village in which it is produced.

It is not, however, in most cases, a difficult matter to devise a scheme which may overcome the objections of the farmer and at the same time provide for the local requirements in regard to milk.

(c) OTHER "ESSENTIAL" REQUIREMENTS.—Amongst other "essential" provisions must be included arrangements for the satisfactory disposal of sewage, either in the gardens or otherwise; the provision of a supply of wholesome water; and other matters of a like kind necessary for the health of the village. Mention should perhaps be made, when considering essential conditions, of access to playing fields.

While, however, the County Committee can, and should, if desired, assist with the provision of the ground required, I do not think they ought to go much further, as the management of the ground and its use to the best advantage should be left to the villagers themselves.

Desirable Requirements.—In addition to these essential requirements the schedule should draw attention to some other matters, which are scarcely less important in that they go far to make up the amenities of rural life; matters such as arranging for the marketing of the produce grown in the village, and the development of suitable rural industries.

It is most desirable that greater facilities should be given for the use of the telephone. A first practical step should be for all country offices, now fitted with the ordinary telegraph, to have their instruments converted into telephones, and that all villages through which posts carrying wires are now laid should, on demand, be provided with a telephone service. The party telephone line is a failure. The essence of all communication is that it should be speedy, and that it should also

be secret. The party telephone can never be made secret, and that is the principal cause of its failure. The much needed expansion of the telephone service in rural districts must take place on the lines of an efficient and secret service.

Rural Industries.—The encouragement of appropriate kinds of rural industry can and should play an important part in rural reconstruction. A suitable industry will provide alternative sources of income, and part-time employment in slack periods of the year, while if it is a full-time industry it may well provide useful and welcome employment for the wife and the family.

Whatever steps are taken, however, to re-establish old, or to develop new, industries, sweated labour should be carefully guarded against, as no permanent advantage can accrue either to the State or to those employed in the industry, if the industry is unable to pay a living wage to its workers.

Conclusion.—Such then is the machinery which should be established, and these the plain matter-of-fact lines along which village organisation should proceed.

There is, however, one word of caution which I would like to utter, and it is this. In any schemes which are promoted there must be no taint of patronage, and there must be no trace of welfare, that is to say in the sense of instructing people as to what is good for them. No one hates more than the dweller in a rural district being told what is beneficial for him.

In conclusion, I would say that if it is possible to sum up in one word the essence of a policy of rural organisation and development, that one word is "sympathy"—not merely the sympathy of a few kindly words, but a real, enduring, constructive sympathy, the sympathy of doing everything possible to advance the cause of the rural dweller. Too long has the State treated him with neglect, but this policy must be changed. The State owes to each one of its citizens, whether they be townsmen or countrymen, the right to live, the right to live a decent life, and a life in which the broad avenues of opportunity shall be open.

REPORT ON FARMS TAKEN OVER BY AGRICULTURAL EXECUTIVE COMMITTEES.*

REGULATION 2M of the Defence of the Realm Regulations gave the Board wide powers for securing the better cultivation of land, including the power to enter on and take possession of any land which in their opinion is not being so cultivated as to increase as far as practicable the food supply of the country, and after entry on any land to arrange for its cultivation by any other person, whether by contract of tenancy or otherwise. These powers were delegated to County Agricultural Executive Committees constituted for each Administrative County in England and Wales under the Cultivation of Lands Order, 1917. The powers have been exercised in practically every county in England and Wales, and the number of instances in which Executive Committees have taken possession of badly-farmed land under the Regulation is over 1,000, comprising a total area of about 64,000 acres. In a large number of cases the land has been let to suitable tenants for the maximum period permitted by the Defence of the Realm (Acquisition of Land) Act, 1916, that is to say, for the duration of the War and two years thereafter. The larger part of the land, however, has been kept in hand and farmed by the Executive Committee, either under the supervision of a member of the Committee or of one of its District Committees, or under the management of a paid farm bailiff. In some counties, such as Essex, Kent, Leicestershire, and East and West Suffolk, practically all the land taken over by the Committee has been dealt with in this way, and in the whole of England and Wales an area of approximately 38,600 acres is being farmed either directly or indirectly by the Agricultural Executive Committees.

During the past year, officers attached to the Technical Division of the Food Production Department have inspected a large number of the farms that are being managed by the Committees, and their reports generally afford striking evidence of the beneficial results of the Committee's action. In an article of this character it is not possible to include reference to all such cases, but the following instances have been selected as giving a general idea of the work that has been accomplished.

Case No. 1 (Cheshire).—About 90 acres of worn-out grazing land in a large park were taken over by the Agricultural Executive Committee in January, 1918. The grazing value of the

* This report, in a modified form, will shortly be issued as a pamphlet.

land was practically nil, the herbage being of very poor quality, consisting largely of *Agrostis* and *Sedges*. The soil was a free-working sandy loam, the land being on a gentle slope facing north and east. Work began on January 24th, and the land was ploughed down-hill with a one-way plough. In order to secure complete inversion of the sod the first furrow was taken up and carted away, subsequent furrows being ploughed 8 in. deep; a skim coulter was used, and the sod caused no trouble afterwards. After ploughing, the land received $\frac{1}{2}$ ton salt and $\frac{1}{2}$ ton lime per acre. It was disc-harrowed about 8 times and then ridged up. About 4 cwt. sulphate of ammonia and 8-10 cwt. superphosphate per acre were applied. Potato planting began about 6th May, and was completed by the end of the month. A very good crop resulted, and the cultivation had been performed in such a way that the area of nearly 90 acres presented a fine sight, particularly when compared with the rough, practically derelict park land adjoining. The Board's Inspector, who visited the district in October, 1918, remarked that the way in which the land had been brought into a comparatively high state of cultivation in such a short time deserved high praise.

Case No. 2 (Devon).—This farm, of 134 acres, was taken by the Agricultural Executive Committee in October, 1917, when it was all in grass. During the winter of 1917-18, 73 acres were brought under the plough. Except for a small amount of the preliminary ploughing, done by a hired man, the whole of the work has been carried out by women. At first a permanent staff of women was employed, but it was then decided to use the farm as a training centre for women, for which purpose it was well suited. The farm was inspected on 12th July, 1918. An average crop of wheat was growing on 20 acres of the land, and a very fair crop of oats on 37 acres; 4 acres were being fallowed, and the remaining 12 acres were under mangolds and potatoes, the latter being an excellent crop, and the former very good, but rather thin. The corn crops had suffered severely from the attacks of rabbits coming from an adjoining farm. All the crops followed old grass, and in the case of the corn crops and mangolds a single ploughing only had been given. The ploughing was mostly done by a Syracuse one-way riding plough, which had apparently done excellent work even in quite unskilled hands. The grass land included 28 acres of hay, of which about half had been cleared at the date of inspection. The live stock on the farm comprised two teams of useful working horses, a spare horse for odd jobs, and 12 cows

with two young calves. The farm buildings were of satisfactory size and construction, and in excellent and clean condition; in fact, the farmyard was the best kept that the Inspector had seen that summer. In view of the fact that practically all the labour was quite unskilled, the condition of the crops and of the farm as a whole testified to the efficiency of the management.

Case No. 3 (Dorset).—This Common of 55 acres was taken over by the Agricultural Executive Committee in November, 1917, all the parties concerned having consented to the Common being cultivated. The land was ploughed and pressed with steam tackle in December, and allowed to lie fallow until February when it was dressed down and sown with oats (Garton's Abundance) in March. No top dressing was applied. An excellent crop, over 7 qr. per acre, was secured. The Committee estimate that the profit from the first year's working amounted to nearly £500. Wheat has been sown in the present season, and, assuming a crop of 8 sacks per acre, the net profit for 1918-19 is estimated at about £400.

The following facts are interesting as showing the value of the Committee's action in this case from the point of view of food production. Before being taken over, the Common was let for grazing, its value for this purpose being not more than 10s. per acre. The practice was to open the Common to the commoners on 12th May, and usually about 500 head of stock were turned in, a fee of about 4d. per head being paid to the Hayward. In average years, three days after the opening of the Common there was practically no grazing left, and most of the stock were then removed. In exceptional years the stock might remain about 7-10 days. The number of stock left on the Common for the remainder of the season was usually not more than 20-25 head, or one store beast to 2½ acres.

The gain in food to the nation may be illustrated as follows :—If the oat crop grown in 1917-18 were entirely used for live stock it would provide for about three times as many stock as the original pasture, or, assuming four-fifths of the oats to be reserved for human food, and the seed to be deducted, the produce would provide oatmeal equivalent to the subsistence diet of 90 persons for a year, and, *in addition*, 50 per cent. more cattle food than the original pasture.

Case No. 4 (Essex).—This farm is typical of some 12,000 acres of heavy grass land in the county. About 20 years ago the farm was acquired as a building estate and sold out in small plots. A few tin shanties were erected and one or two plots were pegged out; otherwise nothing was done. The

land became overgrown with scrub and barely sufficed to maintain a few cattle and sheep in store condition. Hedges grew wild, ditches filled up and drains became blocked. The farm was taken over by the Committee in the summer of 1917, and cultivation began in the early autumn under the direction of an experienced local farmer. An inspection was made on 7th May, 1918, and the following extracts from the report are interesting as showing the work that had been accomplished:—

“The whole of the land has been cleared of bushes, the hedges have been cut down and the ditches scoured. The last-named operation has revealed the presence in some of the fields of tile drains $3\frac{1}{2}$ to 4 ft. deep, which are now running freely. One field (23 acres) was ploughed up by tractor in August, steam-cultivated twice and stetched up. Slag, at the rate of 10 cwt. per acre, and 1 cwt. per acre of sulphate of ammonia, were applied, and Rivett wheat was drilled in October. The crop looks well and shows no sign of wireworms. Another field of $26\frac{1}{2}$ acres was steam-cultivated three times in September, and about 10 acres were horse-ploughed in winter. The latter portion has been drilled partly with spring oats and partly with mangolds. The remainder was intended to be bare-fallowed, but as a result of the fine spring weather about 9 acres were worked into a respectable seed-bed and drilled with vetches, which promise well. This is a valuable and interesting experiment, as with ordinary luck the vetches should be got off in good time to prepare for autumn wheat.

“Another field of 29 acres was ploughed by tractor in September, and subsequently steam-cultivated and stetched up. About 3 acres were sown with winter beans and the rest with spring oats. The beans look well, but the oats (Abundance) are, in places, badly attacked by wireworms, and are to be patched, part with linseed and part with barley.

“A further field of 10 acres was steam-cultivated three times in September and sown in spring with dun peas. These, on the whole, look very well, but are clearly the best on a small portion that happened to be ‘raftered’ in May, thus pointing to the advantage of early working on this class of land.

“Of the total area of 166 acres, 82 acres are already under crop, 35 acres are being bare-fallowed in preparation for wheat next autumn, and 49 acres are still in grass.

“The transformation effected on this land reflects the greatest credit on the management. Many difficulties have been faced and overcome; when the tilth was not good enough for one particular crop another has been substituted, with the

result that every possible acre is carrying a crop of some kind, and a series of experiments is in progress which should be of the utmost value to agriculturists."

Case No. 5 (Hampshire).—This is a compact farm 600 acres in extent, mostly arable, and situated on clay or red loam of good quality overlying the chalk. For about 20 years before the War it had been occupied by successive owners, but previously its rental value would probably have been 10s. or 12s. an acre. In 1916, when the farm was brought to the notice of the Board, the owner and occupier of the farm was a wealthy business man, who only occasionally visited his property, which was managed by his bailiff. A report made to the Board in February, 1917, showed that the farm was then in a deplorable condition, due to an utter lack of business management. There were 17 corn ricks on the farm of the harvest of 1914, 1915 and 1916, all infested with vermin and rapidly wasting. The stock comprised 13 horses, 100 ill-conditioned sheep and 16 young cattle. There was an indifferent equipment of implements, including two serviceable grass cutters and two binders, but much of the machinery lying about was broken down or out of order. The arable land had been allowed to get extremely foul, and nearly 200 acres was stated to be in such a condition that only a summer fallow and a most thorough cleaning could possibly restore it to a condition in which it could grow crops. The labour on the farm, though scanty, was sufficient, properly directed, to have produced far better results.

The farm was taken over by the Agricultural Executive Committee in March, 1917, and a bailiff installed, who worked under the direct supervision of the Committee's Executive Officer. An inspection was made in June, 1918. Of the ploughed area, 400 acres were then under grain crops and 100 acres under fallow. The wheat (210 acres) was growing on land which, with the exception of three or four acres, had been summer-fallowed the previous year. On the whole the crop looked very well, considering the nature of the soil and the state of the farm when taken over, and it was estimated to yield an average of about 4 qr. per acre. The oats (116 acres) included 20 acres taken after old grass, and this crop had been badly thinned by wireworm; the remainder was taken partly after old grass and partly after clover and old sainfoin leys, and was only a moderate crop, largely owing to the dense growth of charlock. Barley (49 acres), including 7 acres after a bare-fallow and 42 acres after oats, was moderate to good. Rye (13 acres) was a good crop and clean. Peas and beans

(13 acres) were thin and not promising, charlock being particularly dense on this field. The fallow land had been well worked, mainly by steam, and was clean.

Owing to the extremely neglected condition of this farm when taken over by the Committee, it was not expected that a model farm would materialise in a short time. There is no doubt, however, that the condition of the farm is being rapidly improved, and the work is a useful object lesson to the district.

Case No. 6 (Kent).—This farm, comprising about 120 acres arable, 10 acres permanent pasture, and 100 acres of Down land, was taken over by the Agricultural Executive Committee in March, 1917. It had been occupied for 4 years by a man who had formerly been a coachman, and who possessed neither the capital, experience, nor ability to make a successful farmer. He seemed to have kept few stock of any kind, and to have regarded much of the land as uncultivable. About half of the Down land affords useful grazing, but no use whatever was made of it. Hedges were overgrown and neglected, and fences and gates were allowed to fall to pieces. Some idea of the neglected state of the farm may be gathered from the fact that a well-known valuer, appointed by the Committee to make an inspection, reported that it was not worth cultivating. Two members of the Committee, both local farmers, had, however, known the farm under better conditions, and on their recommendation the Committee decided to take it over. The tenant was allowed to remain in occupation of the farmhouse and to act as foreman, under the instructions of a member of the Committee.

The farm was inspected in August, 1918. The cropping of the arable land, which had been cleaned and well cultivated, was as follows :—*Wheat* (47 acres), looking well and promising 5 qr. per acre ; *Oats* (15 acres), a good crop, expected to yield 6 qr. per acre ; *Barley* (25 acres), somewhat short in straw, but estimated at nearly 4 qr. per acre ; *Peas* (14 acres), a fair crop being harvested in good condition ; *Clover* (6 acres), had yielded a good cut, and the aftermath was exceptionally good ; *Vetches* (14 acres) were sown on a poor, thin upland field that had been covered with short, mossy herbage ; there was a fair standing crop of well-podded plants that should furnish excellent seed. About 18 acres of the foulest ground are being thoroughly fallowed.

The following extract from the Inspector's report may be quoted :—" It speaks well for the skill and attention of the management that such a marvellous transformation should have

been effected in so short a time. . . . All concerned are to be congratulated on having accomplished a most useful piece of work with the minimum of expense, as well as of hardship, to the former occupier and his family."

Case No. 7 (Leicestershire).—In April, 1917, the Board's attention was drawn to the fact that the keeping of this grass farm (111 acres) was advertised for sale, and it was suggested that some of the land ought to be ploughed up instead of the keeping being let from year to year, as had been customary. The case was brought to the notice of the Executive Committee, and possession was taken of the farm on 1st May, 1917. The whole area was ploughed up, and cropped in 1918 with wheat (95 acres), oats (6 acres), and potatoes (10 acres). The land was heavy, and considerable difficulty was experienced through want of drainage. Between 15,000 and 16,000 pipes were laid, and the ditches were all cleaned out and the hedges cut down. When inspected in July, 1918, the crops looked extremely well and the land was very clean. A field of 20 acres, which was mostly under gorse when the Committee took possession, was carrying a crop of wheat estimated at 7 qr. per acre. The oats were in every way an excellent crop. No manure had been used on the farm except 2 tons of sulphate of ammonia for the potatoes; these had been planted late, but looked very promising. Having regard to the original condition of the farm, the Inspector described the results obtained as wonderful.

Case No. 8 (Norfolk).—This farm of 350 acres, of which 295 acres are arable and 55 acres permanent grass, was taken in hand by the Agricultural Executive Committee in February, 1917. At that time only about 12 acres were ploughed, most of the farm being in outrun leys or derelict. A small herd of dairy cows was kept, but they were of bad type and most of them had to be weeded out by the Committee and replaced. Seed of the rarer pasture plants, *e.g.*, burnet, chicory, and tall fescue, and of cruciferous green crops had been grown in a somewhat haphazard way and left down for two or three years, with the result that the ground had become full of weeds. Requests to clean the land and grow corn were ignored, and the Committee therefore stepped in. The owner-occupier was not short of capital, and it was arranged that the Committee should farm the land with his money.

The work of reclaiming the farm was put in hand at once. Hedges and ditches received attention; gates were purchased and suitably hung. Essential repairs were done to the farm

buildings, which were in a very dilapidated condition. Of the five cottages on the farm, only one was habitable, two were past repair, and the other two were made habitable by the Committee. An adequate stock of implements was purchased, or hired. An inspection of the farm was made on 14th August, 1918. On that date, 194 acres were carrying cereal crops; there were 59 acres of roots, 7 acres oats and vetches, 28 acres clover and rye-grass, and 5 acres bare fallow. Of the cereals, the wheat crop (85 acres) was excellent, and promised to yield 5 qr. per acre; the barley 5 to 5½ qr.; the oats varying from 4 to 6 qr. A rough valuation of these crops, assuming 80s. a qr. for wheat, 60s. for barley, and 48s. for oats, showed a total estimate of over £3,000 as the value of the grain grown in that year. The roots were a little gappy, but otherwise promising, and were exceptionally clean. The "seeds" had yielded about 1½ tons of hay per acre, and there was a good aftermath. The Inspector, in commenting on the exceedingly healthy and prosperous condition of the farm, remarks that the financial results of the Committee's occupation should be eminently satisfactory.

Case No. 9 (Rutland).—A preliminary examination of a Park was made by one of the Board's Technical Advisers in June, 1917. The Park extends to about 900 acres, about half of which is rather densely wooded, too steep, or in other ways unsuitable for immediate cultivation. The remainder was at that time used for grazing for deer and rabbits, along with a few cattle and horses, and was generally in a very rough state. While recognising the difficulties in respect of the fencing necessary, and the fact that the yield of grain in 1918 would probably be low, the Department felt that it was not desirable that such a large area of grass land should be left practically unproductive, and agreed that an attempt should be made to crop a considerable area of the better ground in 1918. In October a more detailed examination of the land was made by the Technical Adviser, and an area of 250 acres was selected as suitable for ploughing during the winter.

The Park was again visited on 15th August, 1918. Nearly 300 acres had been fenced in, and about 200 acres had been broken up. The whole of this land was tractor-ploughed in January, February and March. Owing to the coarse herbage, which was not burnt off, the ploughing was done very roughly, but the land was subsequently well disc-harrowed three or four times, and rolled with a heavy tractor-roller four times (once before and thrice after sowing) so that a firm and satisfactory

seed-bed was obtained. It was not possible to begin sowing till April, and though the corn came up well it suffered severely from drought. The wheat crop (37 acres) was moderate, and looked like yielding 4 to 6 sacks an acre. Barley (150 acres) had suffered from drought, and was not expected to average more than 5 sacks per acre. The whole of the corn land was, however, quite clean, and in good condition for 1919 crops. On the whole, the returns from the land were likely to be much better than one would have expected in view of the lateness of sowing and the character of the season, and the outlook for the whole scheme was regarded as distinctly promising.

In December, 1918, the Board asked the Executive Committee to submit an estimate of the net result of their cultivation of this land for the two seasons 1918 and 1919, including on the "Receipts" side of the account the estimated proceeds of the 1919 crops, and on the "Expenses" side the amounts paid by way of compensation to the owner and tenant. The estimate submitted by the Committee showed that expenses in the two years would be practically covered by the receipts, making no allowance for the value of the fencing.

Case No. 10 (Somerset).—This farm was brought to the notice of the Board in July, 1917, by the Agricultural Executive Committee, who described it as a "notorious case," and urged that anything short of strong action would have a very prejudicial effect in the district. The farm comprises 286 acres, of which about 164 acres were occupied by the owner, and the remainder (all grass) let out for grazing. The land was in an absolutely derelict condition when taken over; the arable land (upwards of 40 acres) was full of weeds and had not been cropped for two to five years; the fences in bad repair and overgrown with docks, brambles and thistles; the buildings needed repairing. With the Board's approval, possession of the greater part (164 acres) was taken in August, 1917, and of the remainder a few weeks later, and it was decided to make use of the farm as a training centre for soldiers.

The farm was inspected in August, 1918. A very large amount of work had been done by the Committee in repairing the buildings, mending roads, restoring the fences and clearing out ditches, etc. Of the total area of 286 acres, 57 acres, practically inaccessible from the homestead, had been let off in two small holdings. Of the remainder, 70 acres were under corn, roots and potatoes, and 29 acres of grass had been mown for hay; the rest was permanent grass, mostly of very inferior

quality. Of the arable land, 24 acres of barley, following partly old and partly temporary pasture, would have been a very good crop but for damage done by rabbits; 15 acres of oats following old pasture and derelict arable were quite satisfactory for the class of land, and promised 5 qr. per acre; 2 acres of mangolds were fair. The potatoes (28½ acres) had been taken mainly on derelict land full of couch and all kinds of weeds, and had been cultivated under difficulties, but the land had been got comparatively clean and the crop was a very fair one considering the circumstances. The method of planting adopted was interesting; the land was tractor-ploughed with a three-furrow plough, and the potatoes were put in every third furrow.

The decision to use the farm as a training centre for soldiers was fully justified by the results. Accommodation had been found for 30-40 men at a time. During the 6 months previous to the inspection, between 70 and 80 had been trained and sent out. The Inspector reported that in his opinion great credit was due to the management for the way in which, with quite unskilled labour, the condition of the farm had been so greatly improved since the Committee's occupation.

Case No. 11 (Staffordshire).—The condition of this farm, of 113 acres, was brought to the notice of the Agricultural Executive Committee in March, 1917. One of the Committee's Executive Officers visited the farm and reported to the effect that it was the most derelict he had ever seen; that a considerable area was suffering from want of drains or defective drainage; that about 90 acres of the land should be arable, but had apparently not been cultivated for several years, and was overrun with squitch grass, some of which appeared to have been mown; and that the only stock on the farm were 8 or 10 cattle and about the same number of horses. This report was confirmed by a Sub-Committee of the Executive Committee, who visited the farm a week later. A further inspection by members of the Executive Committee was made in July, as the result of which application was made to the Board for authority to enter on and take possession of the land. The position was complicated by the fact that the land was glebe, and further by the resignation of the incumbent, so that while the Board sanctioned the entry on the land by the Committee, they expressed the view that the case might be dealt with more satisfactorily by authorising the determination of the tenancy of the existing occupier, thus enabling the Committee to approach the owner with a view to making satisfactory arrangements for the re-

letting of the land. Meantime, however, little improvement had been made by the tenant in the cultivation of the land, and at the request of the Committee an inspection was made by one of the Department's Technical Advisers in February, 1918. His report emphasised the deplorably neglected state of the farm, and the Board thereupon suggested that the Committee should take possession, and arrange for its cultivation. The Committee entered on the farm in March, 1918.

The farm was again visited by a representative of the Department on 30th August, 1918. Since taking possession, the Committee had ploughed up the whole of the arable land that had not been sown at the time of entry, amounting altogether to about 40 acres. It was steam-tackled in the spring, and most of it had been ploughed and cultivated nine times during the summer. Most of the land had been made fairly clean, and the intention was to plough it all once again and sow with wheat in autumn. Of the 60 acres of grass, about 16 acres had been mown, and the remainder let for grazing. An effort was to be made to improve the grass by the application of basic slag. The ditches had been cleaned out, and a considerable amount of fencing done. The farm was clearly in much better order than when taken over, and it was evident that the arable land should yield satisfactory crops in 1919.

Case No. 12 (East Suffolk).—This farm of 148 acres, including about 108 acres arable, was taken over by the Committee in June, 1917. It had been purchased by the occupier about 5 years previously, when it was in fair order, but had since been allowed to fall into a deplorable condition. A report of an inspection made by the Board's Commissioner for the district in May, 1917, included the following remarks:—"Very little of this land is like producing a crop. It appears to be wet in many parts, and there is an absence of any regular system of cropping. There were four horses on the farm, one of which was a fair, useful animal, the other three very inferior. There is a good house empty, and a good cottage empty. Buildings generally are out of repair and very dilapidated." The soil is boulder clay: free-working two-horse land well adapted for corn-growing, but the production of wheat in 1917 was only 103 coombs, at the rate of 4 to 4½ sacks per acre. *

The farm was inspected in July, 1918. The hedges and ditches had been attended to, and much of the land had been fallowed and prepared for corn in 1918. A 12-acre grass field had been broken up and sown, part with oats and part with beans. The cropping of the arable land (120 acres) included

70 acres of cereals, 6 acres of clover hay, 13 acres beans and peas, 3 acres mangolds, 6 acres of potatoes and 22 acres bare fallow. The wheat (50 acres) was some of the best in the county, estimated to yield 5 to 7 qr. per acre; barley (16 acres), a fair, average crop; oats (4 acres), had partly failed and were replaced by potatoes; beans, peas and mangolds were good. The wheat crop was expected to yield between 500 and 600 coombs, or five times the production of the previous year. The fallow was being well worked in preparation for autumn corn. The general condition of the land was very satisfactory, and there was ample evidence of improvement.

Case No. 13 (Warwickshire).—This land was brought to the notice of the Board in the summer of 1917. The area consisted of a farm of about 160 acres, which had been in the tenant's occupation for 27 years, and was entirely in grass, except for a neglected field of about 9 acres; and of an adjoining farm of about 305 acres, over which the same tenant had shooting rights, but which, except for this, was unlet and unoccupied, and had not been farmed for 30 years. In a report to the Agricultural Executive Committee the latter farm was described as generally overgrown with thorn bushes and infested with rabbits, while the ground was covered with worthless herbage. The stock on the tenanted farm comprised 9 cows (7 in milk), 12 calves, 2 ponies and 1 carthorse, all being in very poor condition. The tenant worked the farm without any outside labour. The farm buildings and cottages were either in bad repair or derelict. The whole area (465 acres) was stated to have been previously let at a rental of £500 a year, and the late tenant had grown 60 bush. of wheat per acre on part of the land. With the Board's approval the Executive Committee took possession of the entire area, and immediately set about the work of reclamation and cultivation. The work was done entirely by means of prisoner labour, for which a camp with accommodation for about 100 prisoners was formed on the farm.

The first operation that the Committee had to undertake was to clear the land; this they did by cutting down the bush in the first instance, and then systematically uprooting the stumps with steam tackle. In this way they cleared close upon 100 acres in 1917, and cropped it with beans (27 acres), oats and barley (60 acres), and potatoes (9 acres). When the farm was inspected on 3rd September, 1918, the potatoes were looking very well, the beans had been a very good crop, the oats and barley had not been so successful, the latter, particularly, being disappointing. The work of clearing proceeded throughout

the winter of 1917-18, and an additional 270 acres of the arable land was ploughed early in the summer of 1918. It was then steam-cultivated two or three times and cleared, with the intention of sowing the whole area with autumn wheat.

In reporting on his visit, the Inspector states :—" The hedges which had run wild and could hardly be distinguished from the 'bush,' have all been cut down to the ground, and many hundred yards of ditches have been opened and cleared. The work has been carried out under the direction of a member of the Executive Committee, with the assistance of a resident bailiff. The clearing of the farm and bringing it back to cultivation was a very big undertaking indeed, and the Committee deserve the greatest credit for what they have been able to accomplish."

Previous to taking over this land its letting value was just its sporting or shooting value, about 5s. per acre ; to-day the Committee consider that its letting value is 20s. per acre.

Case No. 14 (Worcestershire).—This farm consists of 180 acres, of which 89 acres are arable and the rest grass. Possession was taken by the Agricultural Executive Committee on 1st January, 1918. Two directions as to cultivation were issued by the Committee in 1917, but were not complied with. The farm had previously been badly managed for some years, and when taken over was in a very bad state.

The Committee appointed a bailiff, who occupies the farmhouse and manages the farm under their instructions. About 40 acres of the grass land were let for grazing during the summer at the highly satisfactory price of £5 per acre. Of the remainder, 21 acres were reserved for hay, the other 40 acres being grazed. When inspected on 30th May, 1918, the stock available for this were 18 young Hereford cattle, 20 ewes with lambs, 1 cow and calf, and 9 horses. The stock were of a good class, and were as much as the land could be expected to carry. A good deal of work had been done in repairing the hedges round the pasture fields. The arable land is heavy clay—4 of 5-horse land. For the most part it had been decided to fallow the land, owing to its extremely foul condition. Oats had been taken on 8 acres, but did not promise more than half a crop ; 3½ acres of roots were clean and promised a fair plant ; 23 acres of barley, following 3-year old seeds, were looking well on the whole. The fallows were being well worked, and promised to be successful.

The concluding paragraph of the Inspector's report may be quoted :—" Considering what must have been the state

of the farm when taken over by the Committee, and the character of the land, the work was well forward, and the management appears to be sound and energetic. There can be no doubt that the farm is being rapidly improved, and that the proposals for dealing with it are on the right lines."

Case No. 15 (Yorkshire).—This refers to a Common of very considerable extent, of which about 200 acres have been dealt with by the Agricultural Executive Committee. Of this area, 76 acres were enclosed and cultivated in 1918. The land was on a comparatively gentle slope, but the surface was irregular and a certain amount of levelling and grubbing of bushes was necessary before ploughing could be carried out. The soil was a sandy loam of fair quality and naturally dry; the herbage was of a benty character, with a considerable proportion of bracken.

Work was not started until 20th March, 1918, after which date two tractors were kept constantly at work. About 46 acres were sown with oats towards the end of May. The cultivation for these consisted of tractor ploughing, repeated disc-harrowing, and two or three rollings with a Cambridge roller. A top dressing of $\frac{1}{2}$ cwt. nitrate of soda (or sulphate of ammonia) and 2 cwt. fish manure was applied about the middle of June. Sowing was done by a disc drill at the rate of 14 stones per acre. Germination was regular and there was little or no sign of attack by wireworm, but growth was checked for some time by drought. When inspected on 20th August, 1918, the crop was rapidly ripening, and seemed likely to produce about 4 qr. an acre. The remaining area, 28 or 30 acres, had been planted with potatoes. The land for this crop had been ploughed, repeatedly disc-harrowed, and then ridged up in shallow ridges so as not to disturb the underlying sod more than could be helped. Any sods turned up were pulled into the rows by hoes. No manure was applied in the rows, but 1 cwt. sulphate of ammonia and 2 cwt. superphosphate per acre were applied after hoeing and before ridging up. At the time of the Inspector's visit the crop looked well, considering the lateness of ploughing; it was quite clean, and promised about 5 tons per acre.

The whole area of 76 acres was enclosed during the summer with a post and 5-rail fence, the timber for which was secured at a local saw-mill for about 1s. a yard. To intercept water flowing on to the area from the higher ground to the north a ditch had been dug. The headlands had been well ploughed,

and a good workmanlike job had been made of the whole undertaking. A shed was erected, by prisoner labour, from timber cut out of trees purchased locally, which would also provide the fencing required for the area to be brought under crop for 1919.

POTATO-SPRAYING EXPERIMENTS AT WYE COLLEGE, 1918.

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At the request of the Food Production Department of the Board of Agriculture, potato-spraying experiments on plots of a considerable size were carried out on the farm at Wye College during 1918. The object of these experiments was to compare the relative efficiency of two and three applications of Burgundy mixture. A small grant was given for the purpose. In order to make the experiments more instructive, plots of the same size were sprayed with Bordeaux mixture and with a new copper-containing mixture, in which sodium silicate replaced the washing soda.

Plan of the Experiments.—As shown in the plan at p. 276, the field used for the potato-spraying experiments was divided into 22 plots; 18 of these consisted of 16 rows and were each $\frac{1}{2}$ acre in area, while the remaining 4 plots, of 8 rows, were the "control" (unsprayed) plots, and were $\frac{1}{8}$ acre each. The variety was Great Scot (1 year from Scotland) throughout, and the whole field was uniform as regards the previous cropping, cultivation, manuring, etc.

Mixtures Used and their Method of Preparation.—The mixtures used for spraying were Bordeaux mixture, Burgundy mixture, "sodium silicate" Bordeaux, and the powder "Strawsonite."

Stock solutions of copper sulphate and of washing soda, at the rate of 2 lb. to 1 gal. water and "milk of lime" at 1 lb. of quicklime to the gal. were prepared as follows: The stock solutions were made in barrels to hold 20 or 40 gal., the barrels having been carefully measured and marked at the 20-gal. or 40-gal. level. To make 20 gal. of the copper sulphate stock solution, 40 lb. of copper sulphate were weighed out and placed in a barrel to which water was then added to the 20-gal. mark; after a few stirrings at intervals the copper sulphate was dissolved. The soda stock solution was similarly prepared. To make 20 gal. of milk of lime, 20 lb. of freshly-burnt quicklime were placed in a barrel and a few gallons of water gradually added until the lumps broke down to form a thick, creamy paste; more water was then added until the 20-gal. mark was reached. This milk of lime was well stirred each time immediately before use.

The Burgundy and sodium silicate Bordeaux mixtures were made up in large wooden vats and the Bordeaux mixtures in galvanised-iron tanks, marked at the 100 gal. level. They were prepared in the following manner :—

1 per cent. Burgundy Mixture. Formula—

Copper Sulphate	..	..	..	10 lb.
Washing Soda	..	..	..	12½ lb.
Water	..	..	..	100 gal.

88½ gal. of water were placed in the vat, 5 gal. of copper sulphate stock solution were added, then 6½ gal. of soda stock solution were added gradually and well stirred in.

1·4 per cent. Burgundy Mixture. Formula—

Copper Sulphate	..	..	..	14 lb.
Washing Soda	..	..	..	17½ lb.
Water	..	..	..	100 gal.

This was prepared similarly, in the following proportions : 84½ gal. of water ; 7 gal. of copper sulphate stock solution ; 8½ gal. of soda stock solution.

Both the Burgundy mixtures, as soon as made, were tested with blue litmus paper, and gave the neutral reaction. It was noticed, however, that blue litmus paper, when floated in these mixtures, changed after some time to a pinkish colour. Both these mixtures proved dangerous to potato foliage and caused scorching (see p. 272).*

1 per cent. Bordeaux Mixture. Formula—

Copper Sulphate	..	..	..	10 lb.
Quicklime	..	..	..	6 „
Water	..	..	..	100 gal.

89 gal. of water were placed in the tank. 6 gal. of milk of lime were added, then 5 gal. of copper sulphate stock solution were poured into the centre and the mixture stirred.

1·4 per cent. Bordeaux Mixture. Formula—

Copper Sulphate	..	..	..	14 lb.
Quicklime	..	..	..	9 „
Water	..	..	..	100 gal.

This was prepared similarly, in the following proportions : 84 gal. of water ; 9 gal. of milk of lime ; 7 gal. of copper sulphate stock solution.

Sodium Silicate Bordeaux Mixture.—This was prepared in the same way as Burgundy mixture, except that sodium silicate was used in place of the soda stock solution. The amount of sodium silicate used was equivalent, in terms of Na_2O , to the washing soda of the 1·4 per cent Burgundy mixture. A flocculent precipitate is formed which remains in suspension a remarkably long time. Under some conditions of mixing the mixture obtained is able to be strained through a fine-mesh strainer ; under other conditions, however, the precipitate tends to become gelatinous, and the mixture cannot be strained.

* These two Burgundy mixtures, prepared from stock solutions in exactly the same manner, caused no scorching in the spraying experiments with British Queen at Malling. (See this *Journal*, April, 1919, p. 71).

The mixture made on the above formula, although satisfying the litmus test when freshly mixed, proved injurious to the foliage in much the same way as the Burgundy mixtures (see p. 272).

Method of Application.—The mixtures were applied by means of a manual spraying machine on wheels with a capacity of 12 gal. Four men were employed, one at the pump, two doing the actual spraying, and the fourth carrying the mixture in pails from the vats or tanks to the machine. The spraying machine was fitted with two lengths of hose, 14 ft. long, with a 6-ft. bamboo rod at the end. Eight rows of potatoes could thus be sprayed at a time, four rows on each side of the furrow along which the machine was wheeled. At the second and third sprayings the haulm had to be turned back with poles from the furrows which were to serve as gangways for the machine. At the first spraying the plants were very thoroughly sprayed, each plot receiving approximately 90 gal. of mixture (about 360 gal. to the acre); at the later sprayings 50 gal. only were applied to each plot.

It may be pointed out here that this type of machine is very useful for securing the thorough spraying of an area of potatoes, *e.g.*, 2 to 5 acres, which is too large for treatment with knapsacks (without the danger of causing discontent among the men) and too small for the economic use of a horse potato-sprayer.

The powder ("Strawsonite") was applied at the rate of $4\frac{1}{2}$ lb. to the plot, by means of the Vermorel "Torpile" knapsack pump (double action), early in the morning while dew was still on the leaves.

Weather Conditions at Time of Spraying.—Spraying commenced on 19th July when Plots 1 and 22 were sprayed. On the following day Plot 2 was sprayed, and about $\frac{3}{4}$ of Plot 21, when a heavy thunderstorm broke, and the remaining $\frac{1}{4}$ was not sprayed until the 22nd. On 24th July, when Plot 19 was sprayed, there was a strong south wind, so that $2\frac{1}{2}$ rows of the control plot to the north of it received some of the spray. A short shower occurred soon after Plot 18 was sprayed and the east end of the 8 rows on the south side of the plot were washed with rain before they were thoroughly dry. On 26th July, when Plot 4 was sprayed, there were short, sharp showers during the actual spraying, followed soon afterwards by other showers and by heavy downpours on the 27th. When Plot 5 (sodium silicate Bordeaux) was sprayed, there was difficulty in straining the mixture; the machine had to be overhauled when the plot was about half done and the spraying had to be finished on the following day.

The other days on which the plots were sprayed were quite favourable for the work, being generally warm and fair with slight breezes, but on 28th August, when Plot 11 (Powder) was treated for the third time, the weather was rather showery after the powder had been put on. .

Observations on the Sprayed and Controlled Plots.—Blight (*Phytophthora infestans*) was first noticed on 2nd August in a patch extending into Plots 11 and 12. From the size of the outbreak it is most probable that the disease had first appeared a week or more earlier. At the time the outbreak was noticed Plot 12 had not been sprayed. On 3rd August a similar outbreak was noticed in the Control Plot 15. The influence which these early outbreaks of the disease had on the general health for the season of the plots in which they occurred, and also in the adjoining plots, is referred to in the following observations made on the various plots during the season :—

No. of Plot.	Mixture.	Dates of Sprayings	Results of Observations.	
			27th August.	27th September.
1	1 % Burgundy twice.	July 19 Aug. 8	Slight scorching injury; no blight.	Blight general on the leaves and occasionally whole stem destroyed; disease evidently "on the run"; most abundant on young foliage, but occurring also on the older.
2	1.4 % Burgundy twice.	July 20 Aug. 9	Severe scorching injury; no blight.	Practically as above.
3	Control	—	No evidence of damage from any early attack of blight; disease now appearing fairly generally on young growth, and "on the run."	All the leaves blackened and dead, but the stems themselves mostly green still.
4	1.4 % Bordeaux twice.	July 26 Aug. 9	No scorching of the leaves; no blight.	Blight "on the run" on some plants; on others just beginning; on the whole less disease than in Plots 1 and 2.
5	1.4 % Sodium Silicate Bordeaux twice.	July 29 Aug. 10	Severe scorching of the leaves, the margins of most being blackened and dead; amount of injury about equal to that in Plot 2; no blight.	Disease general on the young foliage; perhaps slightly worse than Plots 1 and 2, and decidedly worse than Plot 4.
6	1.4 % Burgundy 3 times.	July 31 Aug. 13 Aug. 29	Severe scorching, as in the other Burgundy plots.	Trace of blight on the young leaves.

No. of Plot.	Mixture.	Dates of Sprayings.	Results of Observations.	
			27th August.	27th September.
7	1.4 % Bordeaux 3 times.	July 31 Aug. 13 Aug. 29	No scorching of the leaves; no blight.	Trace of blight on the young leaves.
8	Control	—	As in Plot 3	All the leaves blackened and dead; a few stems also destroyed. Blight fairly general on the young foliage, obviously "on the run."
9 & 10	1 % Bordeaux twice.	Aug. 1 Aug. 17	No scorching of the leaves; no blight.	The leaves almost all blackened and dead from blight; a few still green.
11	Powder 3 times.	July 30 Aug. 6 Aug. 28	Blight "on the run" on the late growth, but less severe than on the control Plots 3 and 8.	Trace of blight on young foliage; only occasionally severer attacks.
12 & 13	1 % Bordeaux twice.	Aug. 2 Aug. 19	Slight damage from early attack of blight; merest trace of disease on the late growth at east end of plot; elsewhere no injury from blight.	More than half the leaves destroyed by blight.
14	Powder 3 times.	July 31 Aug. 7 Aug. 29	Severe attack of blight at east end of plot, but not quite so severe as in adjoining control Plot (No. 15). Elsewhere no evidence of early attack, but blight "on the run;" numerous diseased spots (growing) on the younger leaves.	All the leaves dead; many stems also dead.
15	Control	—	Blight severe throughout plot and obviously "on the run;" damage most severe towards east end of plot, where the stems of some plants were dead; blight less severe in remaining part.	Trace of blight on young leaves.
16	1.4 % Burgundy 3 times.	July 30 Aug. 12 Aug. 29	Severe scorching injury of the leaves throughout plot, resulting in death of edges and tips of leaves, with in-rolling of margins. Severe injury from early attack of blight at east end of plot, where the lower leaves of many plants were killed. Occasionally single leaflets higher up the stem also destroyed in this part of plot. Elsewhere no damage by blight, except that disease was just starting (as a mere trace) on the young fresh growth.	

No. of Plot.	Mixture.	Dates of Sprayings.	Results of Observations.	
			27th August.	27th September.
17	1.4 % Bordeaux 3 times.	July 30 Aug. 12 Aug. 29	No scorching of leaves. Early attack of blight at east end of plot as in Plot 16, but less severe. Merest trace of blight in rest of plot.	Trace of blight on young leaves.
18	1.4 % Bordeaux twice.	July 24 Aug. 7	No scorching injury; mere trace of blight just starting on the leaves formed since the last spraying.	Blight "on the run" on some plants, on others just beginning; on the whole disease less general than in the Burgundy plots.
19	1.4 % Sodium silicate Bordeaux twice.	July 24 Aug. 10	Severe scorching injury, most of the leaves with dead blackened margins; amount of injury about equal to that of 1.4 per cent. Burgundy. Merest trace of blight.	Blight general on the leaves and occasionally stems withering; evidently "on the run" on young foliage; occurring also on the older leaves.
20	Control	—	Blight fairly general at east end of plot, but usually only causing patches on the leaves or killing whole leaves; very few plants with the stems nearly destroyed. Blight less severe towards west end of plot.	All the leaves dead and many stems also destroyed.
21	1 % Burgundy twice.	July 20 Aug. 7	Distinct scorching injury on leaves, but less severe than in Plot 22; the amount of scorching not sufficient to cause any serious damage; mere trace of blight.	Blight general on the leaves and occasionally causing the stems to wither; evidently "on the run"; most abundant on young foliage but occurring also on the older leaves.
22	1.4 % Burgundy twice.	July 10 Aug. 9	Severe and injurious scorching of the leaves often resulting in the blackening and death of the edges and tips of the leaves; mere trace of blight on isolated leaflets; no signs of blight spreading; no dead stems.	As in Plot 21.

Yields of Plots and Results of Spraying.—The following table gives the actual yield, as weighed in the field when the crop was lifted in October, of the total crop (8 rows) of the control plots, and of the 8 middle rows of each sprayed plot, and also the weights of the ware and of the "blights," and the percentage of each in the total crop.

TABLE I.

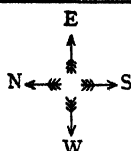
Mixture.	Plot.	Total Crop.		Ware.		Per-centage of Ware	Blights.		Per-centage of Blights
1% Burgundy twice	1 21	cwt.	lb.	cwt.	lb.		cwt.	lb.	
		37	96	31	94	84.1	0	102	2.4
		38	46	34	84	90.5	0	32	0.7
1.4% Burgundy twice	2 22	76	30	66	66	87.3	1	22	1.6
		36	5	31	0	86.0	0	77	1.9
		36	4	32	0	88.9	0	14	0.3
Control	3 20	72	9	63	0	87.4	0	91	1.1
		43	12	36	56	84.7	1	56	3.5
		37	78	32	0	84.9	1	0	2.6
1.4% Bordeaux twice	4 18	80	90	68	56	84.8	2	56	3.1
		43	80	38	58	88.1	0	30	0.6
		39	3	34	0	87.1	0	21	0.5
1.4% Sodium Silicate Bor- deaux twice ..	5 19	82	83	72	58	87.6	0	51	0.6
		36	72	31	56	86.0	0	62	1.5
		35	53	30	84	86.7	0	14	0.4
1.4% Burgundy thrice ..	6 16	72	13	62	28	86.3	0	76	0.9
		37	20	32	46	87.2	0	10	0.2
		34	3	30	70	90.0	0	10	0.3
1.4% Bordeaux thrice ..	7 17	71	23	63	4	88.5	0	20	0.3
		44	13	38	0	86.1	0	52	1.1
		36	54	32	84	89.8	0	10	0.2
Control	8 15	80	67	70	84	87.8	0	62	0.7
		39	102	33	0	82.7	2	18	5.4
		30	70	26	0	84.9	0	70	2.0
"Strawsonite" Powder thrice	11 14	70	60	59	0	83.6	2	88	3.9
		40	49	32	0	79.1	2	77	6.6
		32	58	28	56	87.6	0	63	1.7
1% Bordeaux twice	9 13	72	107	60	56	82.9	3	28	4.5
		40	18	33	84	84.0	0	56	1.2
		38	15	32	56	85.2	0	37	0.9
1% Bordeaux twice	10 12	78	33	66	28	84.6	0	93	1.1
		41	96	35	0	83.6	0	76	1.6
		35	57	30	0	84.5	0	15	0.4
		77	41	65	0	84.0	0	91	1.1

It will be seen that in no plot was the amount of blighted tubers very great, the four control plots giving only 3.5, 2.6, 5.4 and 2.0 per cent. of "blights." Of the treated plots, No. 11, where powder was used, gave 6.6 per cent. of "blights," while the other plot where powder was used gave only 1.7 per cent. The high percentage in Plot 11 is to be attributed to the early outbreak of the disease at the end of July (see above, p. 272), and to the fact that the powder treatment failed to check the disease in the satisfactory manner that spraying with 1 per cent. Bordeaux mixture did in the case of Plot 12, where, with exactly the same early outbreak of disease, there was only 0.4 per cent. of "blights."

Plan of Potato-spraying Experiments, Wye, 1918.

Each unshaded plot had an area of $\frac{1}{2}$ acre; each shaded plot (unsprayed) had an area of $\frac{1}{2}$ acre.

22	21	20	19	18	17	16	15	14	13	12
1.4 % Burgundy mixture twice.	1 % Burgundy mixture twice.		1.4 % Sodium Silicate Bordeaux twice.	1.4 % Bordeaux mixture twice.	1.4 % Bordeaux mixture three times.	1.4 % Burgundy mixture three times.		Bordeaux (Strawmilk) three times.	1 % Bordeaux mixture twice.	1 % Bordeaux mixture twice.
1	2	3	4	5	6	7	8	9	10	11
1 % Burgundy mixture twice.	1.4 % Burgundy mixture twice.		1.4 % Bordeaux mixture twice.	1.4 % Sodium Silicate Bordeaux twice.	1.4 % Burgundy mixture three times.	1.4 % Bordeaux mixture three times.		Bordeaux mixture twice.	1 % Bordeaux mixture twice.	Bordeaux (Strawmilk) three times.



The fungicidal effect of Bordeaux mixture was well shown in the four Plots 9, 10, 12, 13—comprising an acre—which were sprayed twice with the 1 per cent. mixture; here, notwithstanding the fact that the disease had already appeared in Plot 12 before it was sprayed, and also that in Plot 11 (adjoining Plot 10) which was treated with powder, the percentage of "blights" was 6.6, the amount of "blight" was only 1.1 per cent. The 1.4 per cent. Bordeaux mixture, applied either twice or three times, gave also a very low percentage of "blights," viz., 0.6 or 0.7.



FIG. 1.—One of the plots being sprayed with the Manual Spraying Machine, described at p. 271. The machine, which is normally wheeled up the furrow, has been turned sideways for the purpose of being photographed.

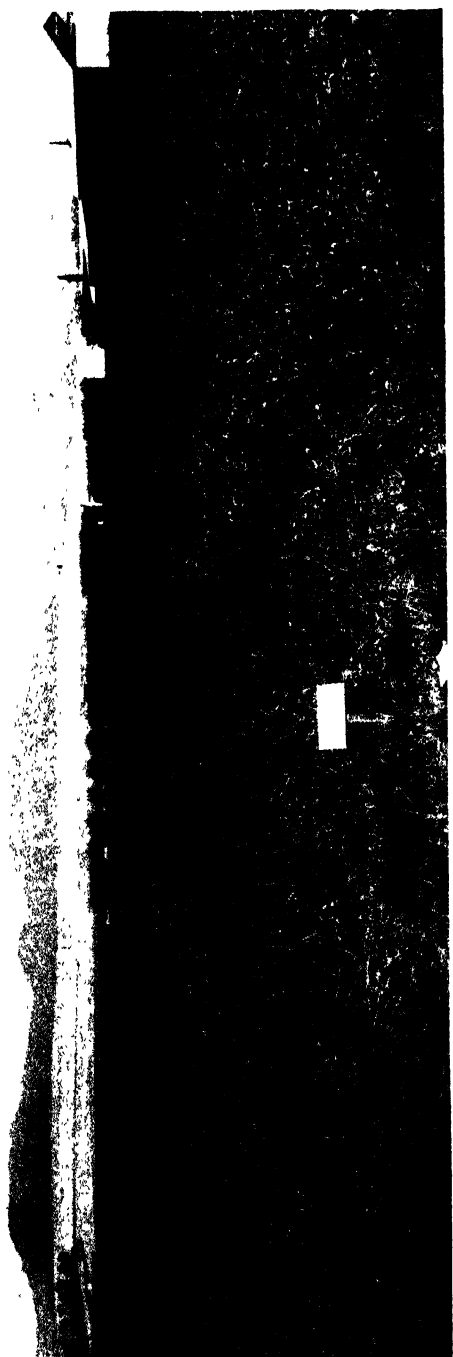


FIG. 2.—Appearance, at the beginning of September, of the unsprayed Plot 8 (*centre*) ; Plot 7, which was sprayed three times with Bordeaux mixture, *on left* ; Plot 9, sprayed twice with Bordeaux mixture, *on right*.

With regard to the fungicidal action of the Burgundy and sodium silicate Bordeaux mixtures, a difficulty arises in judging owing to the fact that a scorching action was shown, which killed or injured many of the leaves (see p. 272).

The results of spraying as shown by the increased yield, or otherwise, of healthy tubers may now be noted.

If the experimental ground be divided into northern and southern halves, and the sprayed plots compared with the nearest control plots, it is found that in the northern half of the field the highest yield of any sprayed plots is that given by Plots 4 and 18, where 1.4 per cent. Bordeaux mixture was applied twice. Here the crop of healthy tubers for the 8 middle rows of both plots was 82 cwt. 32 lb. as compared with 78 cwt. 34 lb. for that of the control Plots 3 and 20—an increase of 3 cwt. 110 lb. The area of the 8 rows in each plot was $\frac{1}{2}$ acre, or $\frac{1}{4}$ acre for the two plots. The increase of healthy tubers due to spraying was, therefore, at the rate of 15 cwt. 104 lb. to the acre.

All the other sprayed plots in the northern half, when compared with the control plots in this half of the field, showed a decrease both of total crop and crop of healthy tubers, the figures for the latter, computed for an acre, being as follows:—

		Cwt.	Lb.
1 per cent. Burgundy, applied twice	.. ..	12	104
1.4 " " " " " "	.. ..	28	16
1.4 " Sodium Silicate Bordeaux, applied twice	.. ..	27	52

It seems clear that this decrease in crop is to be attributed to the injurious action of the above mixtures on the foliage (see p. 272), although it may be noted here that the plots in the other half of the field (see below), sprayed three times with 1.4 per cent. Burgundy mixture, gave an increased yield, although severe scorching injury was recorded.

In the southern half of the field, the highest yield was in Plots 7 and 17, sprayed three times with 1.4 per cent. Bordeaux mixture. Here the crop of healthy tubers from the 8 middle rows of both plots was 80 cwt. 5 lb., as compared with 67 cwt. 84 lb. from the control Plots 8 and 15—an increase of 12 cwt. 33 lb., or 2 tons 9 cwt. 20 lb. to the acre.

All the other sprayed plots in the southern half of the field also gave an increased yield over the unsprayed plots, as follows, the figures being computed for an acre:—

		Cwt.	Lb.
1.4 per cent. Burgundy Mixture, applied 3 times	.. ..	13	12
" " " " " " powder, applied 3 times	.. ..	7	92
1 per cent. Bordeaux Mixture, applied twice	.. ..	38	96
1 " " " " " "	.. ..	35	24

Summarising the results of all the spraying trials, the figures given below are obtained, as the increase, or decrease, of crop of healthy tubers per acre as compared with the crop of the respective control plots :—

	<i>Increase.</i> <i>Cwt.</i>	<i>Decrease.</i> <i>Cwt.</i>
<i>Northern Half of Field.</i>		
1·4 per cent. Bordeaux mixture, applied twice ..	16	—
1·4 " Burgundy " ..	—	28½
1·4 " Sodium Silicate Bordeaux, applied twice ..	—	27½
1 " Burgundy mixture " ..	—	13
<i>Southern Half of Field.</i>		
1·4 per cent. Bordeaux mixture, applied 3 times ..	49½	—
1 " " " 2 " ..	38½	—
1 " " " 2 " ..	35½	—
1·4 " Burgundy " 3 " ..	13	—
Powder (" Strawsonite "), applied 3 times ..	7½	—

It will be noted that 1·4 per cent. Bordeaux mixture applied twice gave results inferior to those obtained with 1 per cent. Bordeaux mixture; this is probably to be explained by the fact that the former was applied under adverse weather conditions, and the latter during weather favourable for spraying operations (see above, under "Weather Conditions at Time of Spraying").

Summary.—1. The use of Burgundy mixtures containing copper sulphate and washing soda in the ratio of 1 to 1½ on the Great Scot variety may result in severe scorching of the haulm. The same is true of the sodium silicate mixture.

2. Under the same conditions Bordeaux mixture produced no scorching injury.

3. The best results were obtained on the plots sprayed three times with 1·4 per cent. Bordeaux mixture, the increase being at the rate of 2 tons 9 cwt. per acre.

REPORT OF THE EDUCATION BRANCH FOR THE YEARS 1917-18 and 1918-19.*

THIS Report of the Education Branch deals with the grants made in respect of educational, advisory and research work during the two financial years ended March 31st, 1918, and March 31st, 1919, respectively, and with the progress made by the various Institutions and Local Education Authorities receiving these grants during the academic years ended September 30th, 1917, and September 30th, 1918 respectively. The period under review thus covers the time when the call on the youth of the country reached its highest pitch, and when, as a consequence, the work of the Institutions and Authorities suffered severely from the resulting drain on their staffs and pupils; while the end of the period witnessed the inauguration of schemes for the development of educational, advisory, and research work in agriculture as part of the general reconstruction of the civil administration of the country.

The grants shown in the tables in this Report include, in some cases, instalments of the subsidies payable in respect of more than one educational year, and comparisons with the amounts paid in the previous year must, therefore, take account of adjustments which have sometimes to be made outside the financial years dealt with.

Higher Agricultural Education.—The grants to Institutions providing Higher Agricultural Education, which are made from the Board's Parliamentary Vote were, during the War, reduced or withdrawn in certain cases, in obedience to Treasury injunctions, where the financial position of the Institution was such as to warrant that course. Thus the total grants paid to these Institutions fell from £16,120 in 1915-16 to £11,960 in 1916-17, £12,077 in 1917-18, and £14,756 in 1918-19, the last-named total being swollen by an emergency grant of £1,500 made to the South-Eastern Agricultural College, Wye, as a result of financial embarrassment due to causes attributable to the War. Three colleges suspended their activities during the War, viz.: the Royal Agricultural College, Cirencester, the Uckfield Agricultural College, and the Holmes Chapel College. It may be hoped that the first-named—the oldest college of its type in the country—may be re-opened to take its part in some form or other in the reconstruction of agricultural education.

* Owing to present conditions this Annual Report is not being issued separately in its pre-war form.

The number of students attending long courses (degree, diploma, certificate, etc.) naturally showed a falling off from the pre-war standard of 1,200; the numbers were in 1916-17 387, and in 1917-18 576, which compare favourably with the 348 in 1915-16; the attendances in 1917-18 were *e.g.*, at Reading, 113; Wye, 95; Harper Adams, 72; Swanley, 69; and the Midland College 41. No regular courses at all were given at Leeds, the staff being entirely free to assist the committees and organisations formed to promote increased food production; while at Oxford practically the whole staff were absent on war work; and the position at some other colleges was nearly as bad.

TABLE I.—*Grants to Institutions for Higher Agricultural Education.*

Name of Institution and Work in respect of which a Grant was Paid.	Amount of Grant.	
	1917-18.	1918-19.
<i>Universities and University Colleges—</i>	£	£
Aberystwyth, University College of Wales—		
Agricultural Instruction	800	1,000
Bangor, University College of North Wales—		
Agricultural Instruction	1,000	1,000
Forestry Instruction	250	250
Cambridge, University of—		
Agricultural Instruction	1,200	1,200
Forestry Instruction	250	250
Leeds, University of—		
Agricultural Instruction	1,100	1,100
Newcastle-on-Tyne, Armstrong College—		
Agricultural Instruction	1,000	800
Forestry Instruction	—	250
Oxford, University of—		
Agricultural Instruction	77	600
Forestry Instruction	250	250
Reading, University College—		
Agricultural Instruction	1,300	1,300
Wye, South-Eastern Agricultural College—		
Agricultural Instruction	1,300	2,800*
<i>Agricultural Colleges—</i>		
Kingston, Derby, Midland Agricultural and Dairy College—		
Agricultural Instruction	1,000	700
Newport, Salop, Harper Adams Agricultural College—		
Agricultural Instruction	1,000	1,000
Swanley Horticultural College—		
Horticultural Instruction	500	556
<i>Special Institutions—</i>		
British Dairy Institute, Reading—		
Dairy Instruction	400	400
Royal Veterinary College, London—		
Veterinary Instruction	650	1,300
	12 077	14 756

* Including War Emergency Grant of £1,500.

A development at Harper Adams College was that at the opening of the 1916-17 session women students were admitted for the first time to the full diploma and certificate courses. In 1917-18 the number of individual students at the College (*i.e.*, including short course students) far exceeded that of any previous session.

The number of students attending special and short courses was satisfactory, viz., 897 in 1916-17, and 1,791 in 1917-18. The numbers were increased by those of the women trained in farm work, and, to a less extent, in the latter year by courses for disabled officers. Of the courses in farm work for women may be mentioned those at Bangor of one month in 1916-17, and six weeks in 1917-18 with respective attendances of 43 and 119; and those at the Midland College with attendances of 85 and 79. At the Harper Adams College in 1917-18, besides 108 women trained in farm work, 55 were specially trained as tractor drivers. At Swanley in 1917-18 nine scholarships were given by the Food Production Department to women land workers for the course in commercial horticulture. By arrangement with the County Councils of Gloucester and Somerset a series of courses, each of a month's duration, for training girls in the elements of market gardening, was held at the Bristol Institute from May to August, 1917; in all 36 students attended the courses, and subsequently engaged in work on the land. At the urgent request of the Ministry of Labour special courses were organised at Cambridge in the summer of 1918 for invalided officers; two courses each of nine weeks were given and attended by 33 and 51 officers respectively.

Courses of training in fruit culture for partially disabled officers intending to take up fruit farming were arranged at the Bristol Institute at the request of the Board of Agriculture and the Ministry of Pensions, the course of training to extend over two years. At Armstrong College disabled officers were placed with farmers providing practical instruction; 12 officers took a special course in agriculture in 1918-19. Special and short courses other than the above-mentioned had reference principally to horticulture, dairying and poultry-keeping. A course at Leeds in war-time gardening in 1917-18 was attended by 350 students.

A considerable number of lectures have been delivered by College staffs outside the Colleges—in some cases owing to the fact that county staffs were engaged on work in connection

with the War Agricultural Executive Committees. This work is set out below in tabular form:—

—		Centres	Lectures.	Average Attendance (approx.)
Aberystwyth	1916-17	36	71	60
	1917-18	45	65	43
Bangor	1916-17	41	57	37
	1917-18	61	142	29
Cambridge	1916-17	—	12	50
	1917-18	7	7	40
Leeds	1916-17	124	335	100
	1917-18	124	273	45
Newcastle (Armstrong) ..	1916-17	45	90	75
	1917-18	33	60	80
Reading	1916-17	44	83	47
	1917-18	52	80	44
Wye	1916-17	33	95	33
	1917-18	59	111	30
Kingston, Derby (Midland)	1916-17	19	38	64
	1917-18	18	25	61
Harper Adams	1916-17	13	93	26
	1917-18	7	14	106

Despite the lack of travelling facilities the demonstration and field experiments at several of the Institutions have been well attended by farmers both individually and in parties. Thus there were over 2,000 visitors to the Harper Adams College in 1916-17 during the principal week of the demonstrations and field experiments; and during the season 1917-1918 there were between 1,500 and 1,600 visitors who came chiefly for the demonstrations of tractors and ploughs given in connection with the ploughing up of grass land. There were about 400 visitors to the Cambridge demonstrations and experiments in each of these years; 46,648 people visited a poultry demonstration train run by the Leeds Institute in 1916-17.

Finally, it should be mentioned that, as a rule, during the War only the most urgently required repairs to buildings have been carried out, with the result that a considerable expenditure will be necessary in several cases to restore buildings to their pre-war state.

Advisory Work.—The grants shown in Table II., which come from the Development Fund, are made in respect of the salaries and expenses of Special Advisory Officers appointed by the Institutions named in pursuance of the Board's Agricultural Research and Advisory Scheme, to undertake local investigations and provide technical advice to farmers in

the areas associated with the Institutions. The work of these officers is intended to supplement the activities of the County Agricultural Staffs, who are invited to refer to the Collegiate Centre any problems requiring more specialised knowledge or *ad hoc* investigation.

TABLE II.—*Advisory Grants 1917-18 and 1918-19.*

Name of Institution.	Amount of Grant provisionally sanctioned in respect of the Academic Year ended 30th September.		Amount of Grant paid in the Financial Year ended 31st March.	
	1917.	1918.	1918.	1919.
Aberystwyth, University	£	£	£	£
College of Wales ..	685	520	517	384
Bangor, University College of North Wales ..	832	1,025	781	962
Bristol, University of ..	875	912	704	970
Cambridge, University of ..	904	845	701	864
Leeds, University of ..	890	890	781	877
Midland Agricultural and Dairy College	407	487	358	356
Newcastle-upon-Tyne, Armstrong College ..	1,000	1,000	1,000	1,000
Reading, University College	1,052	1,010	952	831
Wye, South-Eastern Agricultural College ..	1,000	1,150	1,000	1,150
Total	7,645	7,839	6,794	7,394

Several of the Institutions have supplied the Board with particulars of the number of inquiries for advice dealt with. These are collected in the following table:—

	1916-17.			1917-18.		
	By Post.	Personal Visit.	On Analysis of Samples.	By Post.	Personal Visit.	On Analysis of Samples.
Aberystwyth ..	266	430	100	311	436	119
Leeds	234	126	185	266	148	198
Kingston, Derby ..	375	306	24	259	148	48
Newcastle ..	2,760	120	442	1,700	152	248
Reading	518	332	1,217	650	304	117

The advisory work carried out by the several institutions seems to be largely on the increase; in the period under review the services of advisory officers were very much in request in connection with food production developments, especially the

problems arising out of the ploughing up of grass land and the need of allotment holders for advice. Further, to the advisory officers was entrusted the supervision of the potato spraying and other schemes of the Food Production Department in their respective areas; some undertook special work at the request of the Department, while the time of others was largely occupied by duties at the Department itself.

The following are very brief reviews of the work at the Institutions:—

University College of Wales, Aberystwyth, 1916-17.—Most of the advisory work had reference to the increased production of home-grown foods, by means of an extension of the arable area and by the selection of suitable land for allotments. A considerable number of feeding-stuffs, manures and various forms of lime were analysed. Limestone samples and waste lime products were received for analysis.

1917-18.—In the majority of cases where grass land was brought under the plough it was possible to advise an attempt to raise fertility by the application of nitrogenous and phosphatic manures; in some cases, however, draining was necessary. There was abundant evidence of the need of the soils of the district for lime dressings. There was a marked increase in the number of milk samples received for analysis due to the fear of deterioration of milk resulting from lack of concentrated feeding stuffs.

University College of North Wales, Bangor, 1916-17.—Advice was given by the advisory chemist on soils in 16 cases and fertilisers in 15 cases, and 3 samples of feeding-stuffs were examined for impurities. The advisory botanist gave advice as to treatment of crops attacked by plant disease in 39 cases; 11 prescriptions for seed mixtures were sent at the request of farmers; 10 specimens of plants and weeds were sent for identification; a total of 172 samples of seeds was dealt with. Farms were visited and visits made in connection with experiments.

1917-18.—Thirty-two inquiries were dealt with by the advisory chemist on fertilisers, feeding-stuffs, soils and miscellaneous matters. Researches are being prosecuted into soil plasticity, soil phosphates and colloidal properties of local soils, and a soil survey is being conducted. Milk samples from cheese factories established in connection with the College were examined to the number of 50 per week. The advisory botanist gave advice on plant diseases and insect pests, and seeds mixtures for pastures, and identified plants; experiments were carried out on the eradication of bracken, on pastures, and on the destruction of wireworm. Varieties of local *Festuca* spp. have been investigated.

University of Bristol, 1916-17.—There was a marked reduction in the number of inquiries of the more ordinary character and increase in those possessing special features of interest or importance under war conditions.

The preservation of fruit and vegetables by various methods was the subject of numerous inquiries. In addition to the usual methods of bottling, pulping and drying, the use of various preservatives engaged attention, and the value of several of these substances was examined. Problems connected with jam-making and questions concerning the utilisation of the sugar beet crop for sweetening purposes and jam-making were dealt with.

The majority of inquiries with regard to diseases of plants were concerned with potatoes. There were fewer inquiries on cider and perry making than usual. In the domain of agricultural chemistry the subjects dealt with were : the use of copper as a substitute for copper sulphate in spraying mixtures ; the manurial requirements of wheat ; the manurial value of various samples of superphosphate ; the manurial requirements and the cultural methods needed in certain cases of badly-cultivated land ; the manurial value of horn shavings ; the potash content and manurial value of ashes of sawmill waste.

Special investigations were undertaken as the result of inquiries on the following subjects : the treatment of Rhizoctonia disease of asparagus ; Apple Leaf Scorch ; Apple Fruit Spot Disease ; arsenical poisoning of land through treatment with tannery leather waste ; the manurial value of horse hair refuse ; and Tomato Collar Rot.

Inquiries on plant pests and diseases were received and dealt with. Arrangements for potato spraying in Somerset, Wiltshire, Gloucestershire, Worcestershire and Herefordshire were supervised.

1917-18.—173 inquiries were received through the post mainly in connection with various plant diseases and pests, soil problems, and methods of preservation of fruit and vegetables. The work of this Station has been sufficiently referred to in connection with the previous year's inquiries.

University of Cambridge, 1916-17.—Of 459 inquiries received 72 were dealt with by the advisory chemist, 240 by the advisory biologist and 147 by the advisory agriculturist.

The more noteworthy points were as follows. As regards soils two interesting cases from the Fens were examined : the first was a poor pasture which was found to contain a large excess of calcium carbonate, and the second was concerned with the manuring of poor Fen soil. As regards feeding-stuffs a number of new ones were analysed with a view to their inclusion in feeding rations ; an experimental stave silo was erected and the making and feeding of silage were under investigation. Insect pests were more than usually troublesome ; caterpillars, the Frit Fly and the Strawberry Tortrix were specially noted. Investigation of the Capsid Bug of the apple was completed ; Silver Leaf in plums and the Black Currant Rust caused much damage ; Nettle-head in black currants was under investigation. An interesting case of the occurrence and cure of " Wooden Tongue " in stock was reported.

1917-18.—Of 494 inquiries received 93 were dealt with by the advisory chemist, 245 by the advisory biologist and 156 by the advisory agriculturist.

The problem of unfertile Fen soils again received attention. A number of samples of wood ash giving values between 2.58 per cent. and 8.07 per cent. of potash were analysed. Pests were again very troublesome ; Flea beetles were particularly active ; the life history of the Strawberry Tortrix was worked out and cultural methods were shown to be effective in combating these pests. Fungoid pests were also very prevalent ; Rusts and Silver Leaf on Victoria plums were specially noted ; spraying for Potato Blight continued to show valuable results.

University of Leeds, 1916-17.—A great increase in the advisory work took place in 1916-17. As regards agricultural chemistry the inquiries mostly related to soils, manures, and feeding-stuffs. Lack of lime was found to be the cause of many of the soil problems, but in

some cases sourness was due to smoke. Waste and spent limes were examined for their manurial value. Investigations were also carried out on the common Scab of potatoes, the Swede Midge, the Flea Beetle, the Frit Fly, Wireworms and the Celery Fly.

1917-18.—The ploughing programme of the Government resulted in an increased demand for advice as to cultivation, manuring, etc., so that an increase in the volume of advisory work again took place. As regards chemical advisory work pronounced lack of lime proved the primary cause of the low fertility of large areas of Yorkshire soils, and various experiments with lime are in progress. Inquiries on fertilisers related mainly to sewage residues, textile waste, organic wastes generally, and waste limes. The botanical and zoological work of the previous years was continued.

Midland Agricultural and Dairy College, 1916-17.—The numerous new allotment holders showed eagerness in securing information which would be helpful to them in the cultivation of garden crops; 127 visits were made and 185 replies sent to inquiries on soil problems, manurial treatment, suitable crops, and on the destruction of pests. 27 potato-spraying demonstrations were given and 49 samples of seeds were tested.

1917-18.—Fifty-six cases of attacks by fungus pests were reported. Potato-spraying demonstrations and advice in connection with Potato Blight were given in 67 cases. Twenty-seven visits were paid to allotment holders in connection with crop problems and advice regarding land and crop management was given in 173 cases. Twenty-six samples of farm and garden seeds were tested. Advice was given on the best cultivation methods to adopt in preparing grass land for the willow crop and in reconverting willow bed land to pasturage and tillage. Assistance in securing willow rods for basket-making purposes was given to basket makers, women's village institutes and to others desirous of establishing new basket-making centres.

Armstrong College, Newcastle-on-Tyne.—The following particulars relate to advisory work carried out in 1917-18 :—

The advisory work carried out by the Professor of Agriculture related to 1092 written inquiries, together with a considerable amount of verbal advice given at markets and elsewhere. The feeding of store and of fattening live stock and of milch cows, the question of the milk standard, the choice of crops, the economic purchase and use of artificial manures and feeding-stuffs, seeds mixtures for one or more years ley and for pasture, the suitability of varieties of cereals, potatoes and root crops, the breaking up of pasture land, dairying, and poultry keeping were among the subjects of inquiry. Over 105 farms were inspected; 27 lectures and lecture demonstrations were delivered besides two conducted at Cockle Park. The development of allotments received the utmost aid, information being given on soils, manures and plant diseases by inspections, visits and correspondence. The Cockle Park experiments and demonstrations are well known, but in addition field experimental work throughout the four northern counties continues under the direction of the staff of the College.

Among the work of the advisory chemist may be mentioned the analysis of soils, manures, cattle food and milk; 45 analyses of potatoes were carried out on behalf of the Food Production Department. Lectures were given and visits paid to farms and allotments. In fall

181 applications for advice were received and dealt with by correspondence in addition to verbal advice.

As regards agricultural zoology damage to oats by Frit Fly was considerable; turnips and swedes suffered greatly in the early period of growth from the Flea Beetle and later from surface caterpillars. Many inquiries from allotment holders as to insect and other animal pests were received and dealt with.

In all 307 letters of advice were written and numerous visits paid to farms and gardens by the Adviser in agricultural botany. The work related to seed testing, plant diseases, and foodstuffs.

University College, Reading, 1916-17.—In connection with the advisory work in plant pathology, 25 inquiries were received by letter and 10 specimens examined and reported on; 8 visits were paid. The inquiries in some cases necessitated considerable laboratory work. Research on *Penicillium* has been continued.

South-Eastern Agricultural College, Wye, 1916-17.—The number of inquiries concerning animal pests was 1,250 and numerous farms were also visited, especially in connection with the ravages of Winter Moth and Cabbage Caterpillar. The study of Aphides and potato pests was continued.

In the mycological department the work related to "mildews" treated with sulphides, the immunity of various forms of the hop to mildew, and spraying of potatoes with Burgundy mixtures. Investigations into the Blossom Wilt and Canker disease of the apple were completed and published. About 500 inquiries for advice were received in this department.

1917-18.—The number of inquiries concerning animal pests was 1,490, including various communications in regard to spraying. Investigations related to the trial of substitutes for arsenate of lead as insect killers, dry spraying of insects, Aphid enemies, and Apple Aphides.

The number of mycological inquiries was 300, mainly relating to well-known pests. The investigations of the previous year were mostly continued. The widespread and extensive outbreak of "Brown Rot" on the cherry necessitated the inspection of many cherry orchards. The efficacy of formalin treatment for Covered Smut in barley was established. An investigation into the "Wither-tip" of plum trees was completed.

Work in the chemical department included the study of alkaline sulphide spray fluids the control of Apple Scab, the testing of copper spray fluids for potatoes, problems in connection with the cultivation of flax and the drying of vegetables. The botanical work related to the crossing of flax plants, pasture studies, investigation of the development of fruit buds, and seed germination tests.

Research Institutes.—The services of a considerable proportion of the staffs of Research Institutes in the years under review were requisitioned for work under the Food Production Department, whether at headquarters or in connection with the administration of the schemes of that Department in the provinces. When it is also considered that the staffs suffered equally with those of the colleges from the release of members for military service, the excellent work which the Institutes have continued

to perform in the domain of agricultural research is all the more meritorious.

Table III. shows that, excluding the grants in respect of the Royal Botanic Gardens, Kew, for Plant Pathology, and the Board's Veterinary Laboratory for Animal Pathology, the grants totalled £16,747 in 1917-18, and £21,102 in 1918-19. The addition of the sums in respect of the Board's two stations brings the totals to £27,727 and £24,477 respectively. It was mentioned in the last Report on these Institutes that it was the policy of the Board to concentrate research on a particular subject as far as possible at a single institution; in particular, research on Animal Nutrition is centred at Cambridge and on Plant Nutrition at Rothamsted.

The whole question of the staffing of the Institutes and the means of improving the position of research workers there, so as to make the career more attractive to men of high scientific attainments, has been under consideration, and the Board hope shortly to obtain sanction to concrete proposals in this direction, as well as for extending the work of the Institutes.

The following notes deal briefly with the work at the Institutes:—

Imperial College of Science and Technology.—The work of the College in connection with the effect of the overhead electrical discharge on crop production is well known; it is hoped to publish shortly a report surveying the results of the work up to the present time. Other research has related to the action of artificial light on the physiology of cucumbers forced under glass and the flocculation of colloids by organic salts.

University of Cambridge—Plant Breeding.—In 1916-17 an investigation of two quantitative characters of wheat, namely the length of the glumes and of the grain, showed that when these characters are segregated out in the F₂ generation and in succeeding years, they are not as is usually assumed identical with those of the parents. A further distribution of seed of the new variety "Yeoman" (yield and strength) was made in the autumn after satisfactory large scale trials of it had been made in many districts.

In 1917-18 yields of 8 and 9 qr. per acre of Cambridge wheats were reported frequently, and in two cases (*i.e.*, with "Fenman" and "Yeoman") treble the average yield, or 96 bush. per acre was reached. Milling and baking trials showed that while Yeoman was not equal to Red Fife, it is sufficiently strong to produce a good quality loaf without the addition of imported strong wheat.

In both years the problem of producing varieties of barley with stiffer straws received a good deal of attention. In the latter year a satisfactory start was made with investigations on the inheritance of Wart Disease of potatoes.

University of Bristol.—*Fruit Growing.*—A report on the work of the Institute appeared in this *Journal* for June, 1918, page 316, and there is, therefore, no need to refer to it again at length.

TABLE III.—*Grants to Research Institutes.*

Subject of Research and Name of Institution to which the Grant was Paid.	Amount of Grant provisionally sanctioned in respect of the Academic Year ended 30th September.		Amount of Grant paid in the Financial Year ended 31st March.	
—	1917.	1918.	1918.	1919
<i>Research Institutes.</i>	£	£	£	£
Plant Physiology—Imperial College of Science and Technology	1,600	1,697	1,595	1,756
Plant Pathology—Royal Botanic Gardens, Kew ..	—	—	1,317	1,105
Plant Pathology—Rothamsted Experimental Station	—	3,192	—	1,400
Plant Breeding—University of Cambridge	1,414	1,414	935	1,028
Fruit Growing—University of Bristol	2,520*	2,825*	1,800*	3,197*
Plant Nutrition and Soil Problems—Rothamsted Experimental Station ..	2,850	2,850	2,850	3,800
Animal Nutrition—University of Cambridge	2,163	1,989	1,795	1,793
Animal Pathology—Royal Veterinary College † ..	1,430	1,630	1,176	1,448
Animal Pathology—Board's Veterinary Laboratory ..	—	—	9,663	2,270
Dairying—University College, Reading	1,878	1,930	1,878	1,930
Zoology (Helminthology)—University of Birmingham	1,062	1,077	464	427
Zoology (Economic Entomology) Manchester Victoria University	579	651	543	779
Agricultural Economics—University of Oxford ..	1,100	2,000	1,475	825
<i>Other Research Centres.</i>				
Fruit Growing—South-Eastern Agricultural College, Wye (Malling Fruit Research Station)	500	500	433	500
Animal Nutrition—University of Leeds	1,000	1,000	1,357	856
Poultry and Rabbit Breeding—University of Cambridge	188	192	183	192
Glasshouse Crops—Waltham Cross Experimental Station	500	500	263	671
Woburn Experimental Station	—	—	—	500†
Total	18,844	23,447	16,747‡	21,102‡

* Including £450 formerly paid to the National Fruit and Cider Institute in respect of Higher Education.

† The grant to this Station is conveniently included although the Station is not strictly speaking a Research Institute under the Board's scheme.

‡ Excluding amounts expended at Kew and the Board's Veterinary Laboratory. The inclusion of these amounts brings the totals for the financial years 1917-18 and 1918-19 to £27,727 and £24,477 respectively.

Methods for the dietetic use of cider fruit have been discovered ; for example, it has been found that a useful jelly can be made from cider apples, and that " pomace " is a valuable cattle food. In fruit culture at present, our knowledge of the influence of the " stock " on the " scion " is purely empirical ; the work already done has been mainly systematic, directed to the classification and isolation of the different varieties of stock used by nurserymen. The conditions which are favourable (or the reverse) to the keeping qualities of fruit are being investigated. Various destructive plant diseases have been studied, their life history and mode of attack being established as a preliminary to the devising of preventive measures. It has been established that one of the main desiderata in regard to spraying fluids is to secure adhesive or wetting power, and thereby to ensure that the germs of disease do not escape destruction. The factors which influence this power are gradually being elucidated.

Rothamsted Experimental Station.—Plant Nutrition and Soil Problems.—The main problem investigated during 1916-17 was the loss of fertilising value (as measured by loss of nitrogen) which takes place in farmyard manure during storage, and it was shown that farmyard manure is best kept under anaerobic conditions (*i.e.*, tightly packed) and under cover. The question whether the cost of storage of manure in closed tanks is economically justifiable is being investigated on a private farm. Investigations in connection with the conversion of grass land into arable are those relating to the length of time that buried weed seeds retain their vitality, and the control of wire worm by means of a suitable soil insecticide. Investigations are also proceeding in connection with devices for sterilising the soil by heat.

Of the investigations in progress in 1917-18 that on decomposition of cellulose (*e.g.*, straw) by a hitherto unknown soil organism under aerobic conditions calls for special mention ; the life history, nutrition requirements and general conditions of growth of this organism have been studied. A product has been obtained resembling well-rotted farmyard manure by treating straw with a soluble nitrogen compound diluted to the proper degree, and ensuring the presence of the organism and the necessary aerobic conditions.

As regards artificial fertilisers, the mode of decomposition of cyanamide in the soil has been studied ; the fertilising value of ammonium nitrate has been ascertained, and the change in the fertilising value of basic slag as a result of the extension of the basic open hearth process for melting steel is being investigated.

University of Cambridge.—Animal Nutrition.—In spite of the depletion of staff two important investigations were undertaken in 1916-17. One had for its object the introduction of less wasteful methods of beef production by demonstrating to the butcher and the public that the process of fattening has been carried too far in the past, and that palatable meat can be produced more quickly and economically by shortening the fattening period.* The other investigation related to the food value of milling " offals " as to which much ignorance prevails, chiefly as the result of loose nomenclature, under which products of widely different food value are sold under the same name in different

* An article dealing with this investigation appeared in this *Journal* for September, 1918, p. 623.

parts of the country. The results of this investigation were of great assistance to the Food Controller in connection with the administration of the Orders which regulated the composition of flour.

In 1917-18 research was carried out in connection with the nutritive value of fats; with the chemical problems of cold storage; with the effect of small additions of dried blood and other animal waste products on the growth of pigs.

Royal Veterinary College.—Of research work in Animal Pathology at this Institute reference may be made to that on contagious abortion in mares and joint-ill in foals; contagious abortion in cows; tuberculosis in the horse; and tuberculous mastitis in the cow.

Investigations have shown that contagious abortion in mares and joint-ill in foals are identical, and are caused by a particular species of bacillus which is present in large numbers in the womb and foetus in cases of abortion, and in the internal organs and joint cavities of foals that develop the disease after birth. Endeavours have been made to prepare a protective serum, especially for the prevention and cure of the disease in foals.

The work on contagious abortion in cows is designed to ascertain whether in actual practice it is possible to deal successfully with outbreaks of contagious abortion by carrying out agglutination tests of the blood of all the breeding animals in the infected herd in order to ascertain at the outset which animals are already infected.

Research Institute in Dairying, Reading.—Investigations at this Institute have had reference to rosy milk, cheese mites, the preparation of home-made rennet, discoloration in Stilton cheese, and the viability of tubercle bacilli in the fæces of apparently healthy dairy cows.

The collection of statistics concerning losses and causes of loss in the milk and dairy industries has made it clear that dirty milk is one of the gravest sources of loss in these industries.

Experiments on the preparation of home-made rennet were reported in the Board's *Journal* for August, 1916, September, 1916, and June, 1917; and a report on cheese mites appeared in the *Journal* for January, 1918.

Birmingham University.—Investigations on the effect of toluene on soil protozoa have shown that the effect of partial sterilisation is profoundly modified by the physical condition of the soil and is not merely a function of the protozoan activity.

Victoria University, Manchester.—The more important work at this Institute has been in connection with the life history of the Wheat Bulb-fly; on an Ichneumon parasite of the Apple Blossom Weevil; on the insect fauna of permanent pasture; on the control of the destructive Onion and Carrot Flies, and on the Cynipid parasite of the Cabbage Root-fly.

It has been definitely established in connection with the Wheat Bulb-fly that it occurs in wheat after potatoes and that wheat after oats is immune. The Cynipid parasite of the Cabbage Root-fly has been proved to be a very important agent in the natural control of this very destructive pest.

The tarred-disc method for the protection of cabbages and cauliflowers from the Cabbage Root Maggot was introduced into this country

by the Institute; information on this method will be found in the *Journal* for March, 1917, p. 1222, and April, 1918, p. 59.

University of Oxford.—Agricultural Economics.—This Institute continued its investigations into the costs of production of farm produce.

Malling Fruit Research Station.—The work has reference to the classification and selection of Paradise apple stocks; trials with plum, quince and cherry stocks; varieties and seedling crosses of black currants; apple pruning; varieties and manuring of raspberries; and varieties of hops.

From a large number of Paradise stocks obtained from different parts of the country and the Continent a number of types have been classified, thus showing the present chaotic state of Paradise stocks in this country, and accounting for the variations which fruit growers get from trees planted in similar conditions of soil and aspect. The working of well known varieties of apples on these types is now being undertaken and the influence of the stocks noted.

University of Leeds.—Animal Nutrition.—In 1916-17 and 1917-18, investigations were in progress on the protein requirements of the dairy cow. In the latter year experiments were carried out on the manufacture of lactose from whey, on the soda process of treating fodder straw, on the feeding of damaged grain crops in sheaf, and on the feeding of Brazilian beans to stock.

Cambridge University.—Poultry and Rabbit Breeding.—The research here has dealt with (a) the inheritance of weight, broodiness, egg colour and sex linked characters in poultry; and (b) the inheritance of weight and coat pattern in rabbits.

Waltham Cross Experimental and Research Station.—The market-garden industries are recognising the value of this Station to an increasing extent. A considerable amount of advisory work is carried on both in the Lea Valley district and in other parts of Great Britain.

The experimental and research work is concerned with sources of error and uncertainty in glasshouse experiments; the management and cultivation of tomatoes; the manuring of cucumbers and tomatoes; and effect of sterilisation on crop yield. Some preliminary work was also done in 1918 on methods of eradicating the caterpillar of the Noctuid Moth, *Hadena oleracea*, which does so much damage to tomato crops under glass.

Rural Agricultural Education.—The schemes of agricultural instruction in the counties continued to be worked in the modified form necessitated by war conditions. Class instruction in specifically agricultural subjects was given only in rare instances, but the Agricultural Organisers, who were in most cases employed as Executive Officers of Agricultural Executive Committees, largely extended the scope of their advisory activities. Instruction in horticulture by means of classes, lectures, practical demonstrations and advisory visits was provided by the majority of County Authorities, and also by a considerable number of County Borough Authorities, special

attention being given to the needs of allotment holders. Frequently the services of the horticultural instructors were utilised in connection with schemes initiated by the Food Production Department. The important work accomplished by County Authorities in providing increased facilities for instruction in cheese-making has already been fully dealt with in this *Journal*, in June, 1918, p. 322, and December, 1918, p. 1087. Instruction in poultry-keeping was provided in about thirty counties, and the advice of the instructresses was eagerly sought in view of the special difficulties felt by poultry-keepers as a result of the food shortage.

Particulars furnished by the Local Authorities in respect of the School Years 1916-17 and 1917-18 are summarised below. It may here be mentioned that this Section takes no account of schemes for the emergency training of women for service on the land, which were administered by the Women's Branch of the Board.

Organised Day Courses.

Subject.	No. of Courses.		No. of Students.	
	1916-17.	1917-18.	1916-17.	1917-18.
Dairying (chiefly Cheese-making)—				
(i.) Travelling Schools ..	279	379	2,987	4,614
(ii.) Fixed and Co-operative Schools	15	25	136	256
Poultry-keeping	7	10	103	101
Farriery	2	1	25	10
Basket-making	—	1	—	8
Total	303	416	3,251	4,989

Evening Schools and Classes.

Subject.	No. of Classes		No. of Students	
	1916-17.	1917-18.	1916-17.	1917-18.
Agriculture	15	4	201	88
Horticulture	70	94	1,685	2,266
Poultry-keeping	46	30	883	571
Farriery	2	3	32	53
Basket-making	3	5	34	84
Total	136	136	2,835	3,062

Lectures and Other Meetings.

<i>Subject.</i>	<i>No. of Meetings.</i>	
	<i>1916-17.</i>	<i>1917-18.</i>
Agriculture	583	372
Live Stock	20	40
Dairying (chiefly Cheesemaking)	152	434
Horticulture	2,766	2,473
Poultry-keeping	775	600
Bee-keeping	71	169
Total	<u>4,367</u>	<u>4,088</u>

Manual Processes.

<i>Subject.</i>	<i>No. of Meetings.</i>	
	<i>1916-17.</i>	<i>1917-18.</i>
Milking	863	261
Ploughing	8	—
Thatching	31	116
Total	<u>902</u>	<u>377</u>

The returns from nine institutions providing residential courses of the Farm Institute type show that instruction was provided for 317 students in 1916-17, and 389 students in 1917-18. In most cases these institutions were also utilised in connection with the training of National Service and other women workers on the land.

The total sums distributed by the Board as grants in aid of schemes of Agricultural Education maintained by Local Authorities were £13,122 in the financial year 1917-18, and £22,713 in the financial year 1918-19. Payments to individual authorities in each year comprised in general an instalment on account of the grant due in respect of that year, together with the balance of the grant earned in respect of the previous year. The grants available under the Regulations were supplemented by special allowances under the Scheme for the Encouragement of Cheese-making in those cases where authorities had increased their normal staff of dairying instructresses. These supplementary grants amounted to £45 in 1917-18, and £487 in 1918-19.

The grants sanctioned in respect of the provision of Agricultural Education by County Education Authorities in the financial year 1916-17 and 1917-18 are shown in the following table:—

*Grants to County Education Authorities in respect of
the provision of Agricultural Education in the Financial Years
1916-17 and 1917-18.*

County.	Grant for year ending 31st March, 1917.	Grant for year ending 31st March, 1918.	County.	Grant for year ending 31st March, 1917.	Grant for year ending 31st March, 1918.
<i>England—</i>	£	£		£	£
Bedford	22	23	Brought forward	8,924	9,301
Berkshire	352	350	Somerset	257	275
Bucks	56	89	Stafford	665	375
Cambridge	10	10	Suffolk, East ..	260	123
Cheshire	1,275	975	" West ..	16	13
Cornwall	391	460	Surrey	906	970
Cumberland	400	720	Sussex, East ..	197	170
Derby	200	135	" West ..	263	220
Devon	475	515	Warwick	76	—
Dorset	93	9	Westmorland ..	145	160
Durham	600	1,200	Wiltshire	275	505
Essex	663	925	Worcester	300	455
Gloucester	168	140	Yorkshire	1,140	2,280
Hampshire	560*	420*			
Hereford	216	395	<i>Total—England</i>	13,424	14,847
Hertford	293	390			
Huntingdon	5	5	<i>Wales—</i>		
Isle of Wight ..	75	68	Anglesey	433	405
Kent	1,196	800	Brecon	43	10
Leicester	193	165	Cardigan	171	130
Lincoln (Kesteven)	247	190	Carmarthen	190	110
(Lindsey) ..	249	150	Carnarvon	880	830
Middlesex	55	100	Denbigh	240	355
Norfolk	85	75	Flint	183	290
Northampton ..	55	20	Glamorgan	540	850
Northumberland ..	103	135	Merioneth	74	80
Nottingham	236	375	Monmouth	734	780
Oxford	176	165	Montgomery	346	315
Rutland	100	42	Pembroke	107	110
Salop	285	255	Radnor	82	65
Carried forward	8,924	9,301	<i>Total—Wales</i>	4,023	4,360
			<i>Total—England and Wales</i>	17,447	19,207

* Provisional.

Grants (chiefly in respect of the provision of instruction for allotment holders) were also paid to the London County Council, certain County Borough Authorities, and the managers of a few local schools. The total grants paid in such cases amounted to £352 in respect of the School Year 1916-17, and £440 in respect of the School Year 1917-18, the grantees numbering fourteen in the former year and sixteen in the latter.

Schemes for building Farm Institutes in certain counties remained in abeyance pending the cessation of hostilities, with the result that only two grants of a capital nature were made in the period under review, viz., £648, the balance due in respect of the building and equipment of the Hampshire Farm School at Sparsholt, and £86 in respect of the adaptation and equipment of buildings at the Cheshire County Council's farm at Henhull for purposes of a women's training centre.

A development in the direction of the establishment of Farm Institutes is confidently anticipated during the course of the present financial year, and Local Authorities have been asked to draw up a scheme (see also later) providing, *inter alia*, for the establishment and maintenance of a farm institute or farm school.

It was a recommendation of the Agricultural Policy Sub-Committee of the Reconstruction Committee that the entire cost and responsibility for agricultural education in the counties should be transferred from Local Authorities to the Board of Agriculture. The Board, however, were unable to advise the acceptance of this recommendation, so that on the Local Authorities will continue to fall the primary responsibility for providing and working that improved system of agricultural education throughout the country which must be one of the principal sources of agricultural progress.

The regulations under which grants are given to Local Authorities have been greatly simplified, and largely increased grants have been promised. The simplification has been brought about by regarding the expenditure of Local Authorities on agricultural education as falling under one of two heads: (1) Salaries and Expenses of Organisers, and (2) all other approved expenditure. The increased grants will result from the facts (1) that in regard to the first class of expenditure a grant of four-fifths will be paid; (2) in respect of the second class of expenditure a grant of two-thirds will be paid; (3) the Residue Grant or "Whisky Money" will no longer be taken into consideration, and the Board's grant will be a definite proportion of the approved expenditure without deduction on this account. As a result of these changes grants to County Councils will be more than doubled in the aggregate.

It will be seen that the Board regard the appointment of an Agricultural Organiser as so important that they will in future pay 80 per cent. of his salary and expenses. At present there are about 40 organisers. Their duties and responsibilities are,

shortly, to supervise all the agricultural work done by the county or counties employing them; they may give some instruction, but their main function is to act as organising head of the County Staff and the mainspring of their activities.

Local Authorities have been asked to prepare a comprehensive and satisfactory scheme of agricultural education for their areas by means of:—

- (a) The establishment and maintenance, or contributions towards the establishment and maintenance, of an institution for higher agricultural education;
- (b) The provision of a county staff of Agricultural Instructors, including particularly the appointment of an Agricultural Organiser;
- (c) The establishment and maintenance, or contributions towards the establishment and maintenance, of a farm institute or farm school.
- (d) The provision of technical advice for farmers;
- (e) The provision of regular short courses of instruction at an approved Centre or Centres;
- (f) The provision of local courses, lectures, practical demonstrations, etc., through the agency of the County Agricultural staff or otherwise.

A large development of county work is one of the first requirements of agriculture, if only for the benefit of men who will be placed on the land under the Land Settlement Scheme for ex-Service men.

Poultry Scheme.—The following stations were established during the seasons 1916-17 and 1917-18:—

	1916-17.	1917-18.
Egg Distributing Stations ..	236	147
Day-old Chicks Stations ..	11	4
Incubating Stations	5	4

Egg Distributing Stations.—As compared with 1916-17 the scheme was carried out in 1917-18 on a reduced scale in view of the shortage of feeding stuffs, but the maintenance in the latter year of the best of the existing stocks was secured; further, the benefits of the egg scheme were restricted in 1917-18 so far as possible to poultry-keepers who were in a position to maintain their stocks with materials not available for human food.

A new feature introduced in 1917-18 was the offer of an additional grant of £1 to stations where satisfactory trap-netting was done; and in response to suggestions from many station holders the distribution of sittings was commenced on 15th January instead of 1st January as previously.

In view of the increased price of food and materials it was necessary in 1917-18 to give station holders a larger return per sitting than in the previous year. This was effected, partly by reducing from 70 to 60 the number of sittings to be sold in order to qualify for the £5 grant, and partly by increasing the charge to applicants for sittings from 2s. 6d. to 3s. 6d. (carriage 6d. extra).

The number of eggs offered to cottagers and small holders in 1917 and 1918 was 252,000 and 108,000 respectively.

In spite of the difficulties in securing poultry feeding stuffs the demand at the majority of stations last season was greatly in excess of the supplies arranged for. This result can in some measure be attributed to the replacement of inferior stock through the medium of the stations; many applicants now look upon the stations as a reliable source for the necessary renewal of stock, and fresh applications are received as the benefits of the scheme become more widely known.

Distribution of Day-Old Chicks.—The number of stations was reduced from 11 in 1916-17 to 4 in 1917-18 so as to include only those with large incubating plants. The number of birds to be offered in order to qualify for the maximum grant of £10 was also reduced from 70 dozen to 60 dozen, and a slight increase was made in the charge to applicants, viz., from 6s. to 7s. 6d. per dozen.

Applications at all the stations in 1917-18 were greatly in excess of the supply arranged, and it was pointed out by College and County Officers that the amount distributed was totally inadequate to meet the needs of the areas served.

Incubating Stations.—The incubating stations at work in 1917-18 were those at Lledwigan, Lleweni, Henhull, and Kernock; the station which was at work at Madryn in 1916-17 was discontinued in the succeeding year. Valuable progress has been made at the first-named two stations in keeping up the standard of stock and in spreading information. The other two stations in 1917-18 were handicapped by inferior sites which have since been improved. At all stations a very large demand was experienced for the stock.

The amounts paid in respect of these schemes in the last two financial years were:—

	1918-19.	1917-18.
Egg Distributing Scheme ..	£717	£985
Day-Old Chick Scheme ..	50	82
Incubating Stations ..	846	624
	<hr/> £1,613	<hr/> £1,691

A fairly full account of the work carried out under the above schemes in 1917-18 was published in this *Journal* for December, 1918, p. 1,106.

Summary.—In the following summary table the purposes to which the grants of 1918-19, and the corresponding grants of 1917-18, have been applied are shown. In certain cases these figures may later be subjected to slight adjustment:—

	1918-19. £	1917-18. £
Educational Grants to Universities and Colleges	14,756	12,077
Grants for Advisory work	7,394	6,794
Grants to Research Institutes and other Research Centres	24,477	27,727
Grants for Special Research and other Investigations (including Miscellaneous Development Schemes and Emergency Experiments)	2,683	2,577
Research Scholarships (including Expenses of Selection)	—	48
Grants for Farm Schools, Technical Classes, Local Lectures, etc.*	24,411	14,186
Capital Grants in Aid of the Establishment of Farm Schools	86	648
Grants towards the Expenses of Advisory Councils	9	670
Grants for Forestry Advice, Research and Experiments	1,822	1,602
	<u>£75,638</u>	<u>£66,329</u>

Brief reference may be made to the items in this table which have not been mentioned in the above survey. The grants for special research are made to encourage research, usually at other than the Research Institutes, into specific problems; these grants are not ordinarily available for providing the salaries of investigators, and are intended to cover special and incidental expenses.

It will be seen that the grants for research scholarships fell to nothing in 1918-19, as practically all the scholars had joined the Army and no new appointments were made. A scholar who was studying plant breeding in Germany, and who was interned at the outbreak of war, utilised the time at his disposal during his internment by establishing a laboratory at which, in addition to giving instruction in botany and zoology he was able to carry out researches in cytology with

* Includes the cost of apparatus loaned to Local Authorities under the Board's Scheme for the Encouragement of Cheese-making.

such profit to himself that, on his return, he was offered and accepted a lectureship in agricultural botany. The Board have now planned to grant 30 new exhibitions for the period of one year, and to continue 18 scholarships in respect of their unexpired periods; the annual value of each is £200 (as compared with a former value of £150).

At a time when the reconstruction of agricultural education in all its branches has passed from the realm of academic discussion and has become a matter on which both public bodies and educational institutions alike are actively concentrating, the publication by the Agricultural Education Association of a Memorandum* making very definite proposals on the subject so far as England and Wales are concerned is particularly opportune.

**The Reconstruction
of Agricultural
Education.**

The Association in July, 1918, assigned to various committees the duty of each surveying a particular branch of agricultural education, with the result that recommendations are made, in a brochure extending to some 64 pages, under the heads of County Work and Elementary Education; Intermediate Education; University Education; Agricultural Research; Dairy Education; Horticultural Education; Poultry Education; Co-operative Experimental Work; Certificates and Diplomas; the Function of the Farm in Organised Education; the Live Stock Improvement Scheme in Relation to Education; Control of Education and Status of Educational Staffs; and the Fundamental Importance of Co-ordination in Education.

It is not possible here to do more than make extracts from the summary of the recommendations printed at the end of the Memorandum.

Elementary Agricultural Education and County Work.—It is to be regretted that in view of the importance of this part of the subject the Association did not see fit to devote more than the small section allotted to its consideration.

The recommendations are to the effect that a dividing line should be drawn at the age of 16, the aim of continuation

* *Memorandum on the Reconstruction of Agricultural Education in England and Wales*: published by the Agricultural Education Association. Copies may be obtained from the Hon. Sec. of the Association, Harper Adams Agricultural College, Newport, Salop. Price 1s. post free.

school education up to this age being the improvement of general education, with English, arithmetic and rural science as the essential subjects (with the addition of handicraft or gardening for boys and domestic science, dressmaking or dairy work for girls); and specific agricultural educational courses being provided after that age for those who propose to stay on the land.

Classes devoted primarily to practical agriculture and horticulture and extending over two years (with a limitation of the centralisation of such instruction) should, it is recommended, be provided locally for those willing and able to carry their education beyond the continuation school stage.

Thereafter, students fitted for higher instruction should be encouraged by scholarships or otherwise to proceed to a Farm Institute, or possibly, in cases of outstanding ability, direct to the higher college.

Other recommendations with regard to county work are that provision should be made for instruction in the best methods of performing the more highly skilled operations of farm and allied work; that single lectures and short courses of lectures to farmers, gardeners, cottagers and others should be continued, and may be made particularly useful as a preliminary to advisory work in the area; that field experimental work for demonstration purposes at county centres should be continued and extended, and that county educational staffs should be considerably augmented.

Farm Institutes, Agricultural Colleges and University Agricultural Education.—The Association desire that Farm Institutes should be distinguished from Agricultural Colleges by the provision at the former of relatively short courses (with a standard course of between one and two years), and at the latter of longer courses of not less than two years' duration.

As to the nature of the courses, it is suggested that at the Farm Institute sound, practical instruction should be the basis, formal teaching of science by way of lectures and laboratory work being reduced to the minimum necessary for securing an intelligent grasp of the outstanding fundamental principles; while the two- (certificate) and three-year (diploma) courses at the College would give a sound knowledge of the principles underlying the practice and economics of agriculture and allied industries.

It is recommended that scholarships tenable at the Farm Institute should provide for the complete course and should be supplemented by further scholarships, whereby the more

able students would pass to the College or University for more advanced courses of instruction.

Provided an adequate staff is available, short courses at the Farm Institute are recommended in such subjects as dairying, horticulture, poultry-keeping and bee-keeping.

The provision of a farm is recommended in connection with a Farm Institute, suitable for teaching purposes as regards both crops and stock, on which thorough practical instruction can be given. The farm at the College, in addition to serving the purposes of the educational courses, should be utilised as a central experimental farm for the province served by the College; visits from parties of farmers, and the holding at the College of periodical conferences of representative agriculturists with the staff should be encouraged.

With regard to university education the Association state that it is desirable that the universities should be relieved of the duty of providing for courses of a lower than university standard. The opinion is expressed that while a degree course based primarily on the history and economics of agriculture and the development of rural law and local institutions might serve better the needs of the working farmer taking a university course for its general educational rather than its technical value, the number of such students coming forward at present (except, perhaps, at the older universities) is not sufficient to warrant any radical departure from the existing type of course based primarily on science.

For students intending to go out as specialists in one of the sciences bearing upon agriculture, it is recommended that an honours degree course in pure science should be the first step, followed by a post-graduate course in agriculture and agricultural science. The necessity for adequate facilities for research on the part of the university teaching staffs is emphasised, and it is insisted that the demands of administrative duties should not encroach unduly upon the time available for teaching and research.

Agricultural Research. — The section dealing with this subject is of outstanding importance. Various important recommendations of the Association on the question of research are on the way to becoming accomplished facts, viz., the prospect of increased financial provision for research as the work develops and the organisation of a definite research service guaranteeing a satisfactory career and thus attracting and retaining the best men.

In the development of agricultural research institutes the efforts made to establish close touch with teaching, advisory work, and the agricultural industry should, it is insisted, be continued and extended. The suggestion is made that the establishment of a National Agricultural Research Committee to survey periodically the whole field of research and organise co-operative work on problems of outstanding importance might be productive of great good.

The Function of the Farm in Organised Agricultural Education.—The Association have a very interesting section on this question, there being “confusion of thought in the lay mind as to the precise significance of the varied uses to which the farm is put for the purposes of agricultural education.” To clear away this confusion the Association classify these farms as follows:—

(a) *Central Experimental Farms*, attached to a research station and used entirely for purposes of experiment and research.

(b) *Institutional Farms* attached to a university, college, or other teaching institution and used partly for teaching purposes and partly for experiment.

(c) *County Experimental and Demonstration Farms*, used for the duplication under different conditions of experiments carried out at farms of classes (a) and (b) and for the local demonstration of new crops, improved varieties, etc.

(d) *Illustration Farms*, run on strictly commercial lines and intended to demonstrate in a given locality the possibilities of the system of farming—not necessarily that practised in the locality—deemed by the local advisory authority to be the best for the area in question.

It is pointed out that the standard of profit and loss can only be rigidly applied to the last-named type of farm; in all other cases, although financial profit is naturally aimed at, considerations of profit must be subordinated to educational aims.

Dairy, Horticultural, and Poultry Education.—The Association refer to the great lack of well-trained teachers, advisers and experts in dairying subjects; and they criticise the concentration of dairy education in the past on cheese-making and butter-making, pointing out that more attention should be paid to the production and management of milk for direct human consumption. Special value is attached to the organisation of periodical conferences of teachers and dairy workers,

and the opinion is expressed that such conferences should be organised by the Board of Agriculture and Fisheries at intervals of not more than three years.

Horticulture, say the Association, cannot be regarded as simply a branch of agriculture, and the problem of the provision of horticultural education must hence be regarded as largely separate from that of the provision of agricultural education. An outline is given of courses of varying duration suitable for young persons intending to enter upon a horticultural career, and also of educational work suited for the instruction of older persons; the former comprise a university course of at least three years, a college course of two years, and short courses including evening classes.

Finally, the following recommendations are made with regard to poultry education: More prominence should be given to this subject in the curricula of colleges and farm institutes; county work should be closely co-ordinated with the foregoing. A course of at least two years' duration, preparing candidates for a National Diploma in Poultry Keeping or a Poultry Manager's Certificate should be provided by the College, whilst the Farm Institute should provide shorter courses qualifying for a Poultry Worker's Certificate. Special provision for research and experimental work in the subject is urgently needed.

REPORT ON BOARD'S CHEESE-MAKING SCHEME DURING 1918.

THE Dairying Branch of the Board have recently drawn up a Report on the work accomplished during the 1918 season under the Board's scheme for the encouragement of cheese-making.

Within the year under review greater extensions took place in the scope of the work than occurred in any previous year. As compared with 1917 twelve more counties were added to the list of those providing instruction. Forty-two additional teachers were employed, 35 additional travelling schools were in operation, and the number of co-operative cheese schools was doubled.

Courses of instruction were held at 400 more centres than in 1917, and the increases in the number of persons instructed and farms visited were 1,850 and 1,975 respectively.

During 1918 travelling cheese-making instruction was in progress in 46 counties. The extension which has taken place in this type of instruction is at once made clear by pointing out that previous to the starting of the scheme in 1916 4 counties only provided instruction in this subject, and the total number of such schools in existence was 5. There is considerable evidence indicating that a very high proportion of those who received instruction in the travelling cheese schools afterwards practised cheese-making in their own dairies.

A summary of the provision made under the scheme, and the work performed in 1916, 1917 and 1918 is as follows:—

	1916.	1917.	1918.
Number of teachers employed ..	44	61	100
„ „ travelling schools ..	37	44	78
„ „ centres visited ..	280	333	733
„ „ persons instructed ..	3,849	4,415	11,328
„ „ farms visited ..	564	683	2,658
„ „ co-operative cheese schools ..	1	9	18

The special Treasury grant made on the recommendation of the Development Commissioners for the purpose of the scheme was as follows:—

<i>Summary of Estimates.</i>				£	s.	d.
Ten migratory schools .. ..	..	..	..	400	0	0
Twenty co-operative schools .. ..	..	..	..	2,000	0	0
Provision for special grants on teachers' salaries .. ..	..	..	..	600	0	0
Clerical assistance .. ..	..	..	..	100	0	0
Total .. ..	..	..	..	£3,100	0	0

The approximate amounts expended under the several heads were as follows:—

	£	s.	d.
Apparatus for migratory schools	350	0	0
„ co-operative schools	958	0	0
Provision for special grants on teachers' salaries, approximately	725	0	0
Clerical assistance, approximately	25	0	0
Total	£2,058	0	0

During the year the loans of apparatus made to County Authorities were:—Small holders, 17; small travelling pressed sets, 18; co-operative school sets, 9. These, together with those loaned in previous years, now make the total number of loaned sets:—Small holders, 37; small pressed sets, 30; co-operative school sets, 18 complete and 3 part sets.

Travelling Cheese Schools.—The travelling cheese schools have continued to work in accordance with the original scheme, which provided for the school being located at a centre for a period of two to four weeks. As a general rule the period adopted in practice has been two weeks only, a few counties following the longer period of a month.

County.	Travel- ling Schools.	Centres Visited	No. of Pupils.	Farms Visited.	Co-op. Cheese Schools.	Teachers Em- ployed.
Anglesey ..	1	2	16	—	2	3
Bedford ..	1	7	77	35	—	2
Berks ..	2	14	117	111	1	3
Bucks ..	2	11	135	—	—	2
Cheshire ..	1	1	13	—	1	3
Cornwall ..	5	21	203	65	3	7
Cumberland and Westmorland	2	23	423	107	2	4
Cardigan, Rad- nor, Brecon	1	6	82	—	—	1
Carnarvon ..	1	4	62	5	1	2
Carmarthen ..	1	6	47	—	—	1
Derby ..	1	40	800	—	—	1
Devon ..	4	50	652	112	—	4
Dorset ..	2	6	42	40	—	2
Durham ..	2	18	268	57	—	3
Essex ..	—	—	—	—	—	2
Flint and Den- bigh ..	1	3	84	38	3	4
Glamorgan ..	1	99*	110	107	—	1
Gloucester ..	2	28	2,038	—	—	2
Hants ..	2	11	124	16	—	2
Hereford ..	4	43	708	149	2	4
Herts ..	1	1	20	—	—	1
Kent ..	4	11	135	144	—	4
Lincs, Kesteven	1	17	557	4	—	1
„ Lindsey	2	15	285	121	—	2
Merioneth ..	1	4	47	—	—	1
Middlesex ..	1	2	90	—	—	1
Monmouth ..	1	1	30	—	—	1
Montgomery ..	1	8	126	—	2	3
Northampton ..	2	10	139	59	—	2
Northumberl'd.	1	60	960	—	—	1
Oxford ..	1	8	80	38	—	2
Pembroke ..	1	7	76	50	—	1
Salop ..	2	16	169	173	—	2
Somerset ..	4	62	644	406	—	4
Stafford ..	1	14	538	—	—	1
Suffolk, East ..	1	16	139	189	—	1
„ West ..	1	6	108	—	—	1
Sussex, East ..	2	8	134	18	—	2
„ West ..	3	8	233	91	—	3
Warwick ..	1	9	165	160	—	1
Wilts ..	3	16	153	—	1	4
Worcester ..	1	14	140	250	—	1
Yorks. ..	6	29	359	53	—	7
	78	735	11,328	2,598	18	100

* House-to-house instruction.

The instructresses conducting these schools continue to encourage students to supply the milk of their own herds for instructional purposes, and, as the class progresses, to blend the milk brought in by several students for the purpose of making a cheese of larger size on a co-operative basis. Thus the schools continue to lead to a demand for the holding of co-operative schools. In a great measure it was due to this influence that the number of co-operative cheese schools held in 1918 was double that of 1917.

It is satisfactory to report that, notwithstanding the large number of schools held, in no case was there anything approaching a failure, and it is remarkable that such a large body of instructresses recruited under considerable difficulties should have rendered such uniformly good service.

Co-operative Cheese Schools.—The work of the 18 co-operative cheese schools has been highly satisfactory. The amount of milk dealt with daily at each school varied from 100 to 400 gal., the greater portion of this milk being that obtained during the flush season of the year, which might otherwise have been put to a less useful purpose.

Nearly the whole of the cheese made was graded "A," which reflects great credit on the instructresses' handling of mixed milks.

In addition to providing striking business examples in co-operation these schools have also been excellent centres for training cheese-makers and factory workers. Approximately 200 received tuition by this means. The co-operative cheese schools in most cases have resulted in the formation of registered co-operative dairy societies. Thus, it is known that at 12 of the 18 centres at which these schools operated last year co-operative societies have been or are about to be registered, and that since the introduction of this type of demonstration teaching 22 dairy co-operative societies have been registered and are conducting co-operative dairy businesses, all of which have resulted from either the direct or indirect influence of the schools.

One effect of the school has been the establishment of the cheese-making industry in several new districts. This is especially applicable to Cornwall, Devon, Hereford and North Wales. In each of these districts there is every probability of the industry becoming permanent and proving of benefit to those concerned. In these areas there are many indications that the number of cows kept is on the increase, largely owing to the introduction of the cheese-making industry.

Reports received both from the Inspectors and County Authorities show that a great proportion of those who were given instruction put their teaching into practice in their own dairies, and it is reasonable to conclude that the instruction provided under the scheme did a great deal during the period of war to relieve the shortage in the supply of cheese, particularly in the rural areas, and this was especially beneficial in the case of agricultural labourers.

There is still considerable scope for the development of the industry, and the fact that Great Britain does not at present produce more than one-fourth of her cheese requirements makes it obvious that a further increase is necessary.

At 12 of the centres where the schools were held during 1918 co-operative societies have since been formed, and at three others the suppliers have become members of existing societies.

Increase of Co-operative Cheese Factories.—As the result of the co-operative cheese schools held during 1917, 10 co-operative cheese factories were equipped and started during 1918. Eight of these are the direct result of the schools, and two other societies were registered in consequence of the indirect effect of the demonstrations. The following are those formed after the schools:—

Haslington	..	..	..	Cheshire.
Wellington	..	..	..	Hereford.
Dinmore	..	..	..	"
Lostwithiel	..	..	..	Cornwall.
Bridge Sollers	..	..	..	Hereford.
Camelford	..	..	..	Cornwall.
Stothians	..	..	..	"
Gwinear	..	..	..	"
Llangerniew	..	..	..	Denbigh.
Eifionydd	..	..	..	Carnarvon.

At two other centres—Pool Quay (Montgomeryshire), and Redlynch (Wilts)—cheese-making has been continued and carried on on co-operative lines, although not as co-operative societies.

Voluntary reports submitted from Cornwall and North Wales show that the establishment of these factories in calf-rearing districts has not reduced the number of calves reared, and that more cows are being kept in consequence of the factories being established.

In the following three cases the increase in the cow population is said to be due to the influence of the co-operative factories.

<i>Factory.</i>					<i>Increase in Cow Population.</i>
Dinmore	..	..	..	..	50 per cent.
Llangerniew	..	..	..	..	25 "
Camelford	..	..	..	..	45 "

FACTORS CONCERNED IN THE LAYING OF CORN CROPS.

IN the latter part of the autumn of 1918 an inquiry was made on behalf of the Food Production Department of the Board into the factors concerned in the laying of corn crops. A schedule of questions bearing on various aspects of the subject was circulated and the following notes summarise the information obtained from replies dealing with 65 crops of wheat, oats and barley, and a certain amount of general information provided by organising officers who assisted in the inquiry.

The majority of replies were received from Wales and the western parts of the country, relatively few coming from the more important corn-growing districts of the east and south-east portions.

The inquiry has failed to bring out clearly any new information on the subject. As, however, the laying of crops is a factor of such importance in limiting the yield per acre it may serve a useful purpose to place its main results on record.

The laying of crops is most likely to occur when the crops are grown under conditions tending to produce heavy yields per acre, though in exceptionally bad weather even light crops may become laid. Grain crops following potatoes or market-garden crops, or on land heavily manured for a root crop, are especially apt to be beaten down in rough weather. Top dressings of nitrogenous manures, such as nitrate of soda or sulphate of ammonia, also tend to produce easily-laid straw. In fact anything leading to excessively rapid and sappy growth during the late spring and early summer acts as a predisposing cause.

Unfortunately it is as impossible to gauge accurately the maximum quantity of nitrogenous manure that can be applied with safety as to forecast the chances of a long spell of forcing weather in May or June, and some risk has to be taken if a heavy crop is to be secured. A knowledge of the conditions tending to prevent laying, however, may diminish the risk considerably.

The completed schedules showed a general agreement regarding these conditions. One, on which considerable stress

was laid in many cases, was that the early-sown crop was more likely to stand satisfactorily than the crop sown late in the season. Whilst this applied to both autumn- and spring-sown crops, the beneficial results of early sowing are perhaps most clearly marked in the latter. Several correspondents from South Wales attributed the better standing powers of winter-sown oats to this cause, and suggested their more extensive cultivation. The suggestion is probably a sound one, though the freedom from laying may be due as much to differences in the straw structures of the two varieties as to the dates of sowing.

The growth of early-maturing varieties was also suggested as a preventive of laying, the underlying idea being that the early hardening of the straw was often advantageous. This would apply particularly in districts where, on account of high elevation and other causes, the crops tend to mature slowly.

Good evidence was produced to show that a similar result, namely, early maturity, could be obtained by the use of phosphatic manures.

The sturdy growth of the straw is markedly influenced by the quantity of seed sown per acre. As a general rule a heavy seed rate gives rise to an overcrowded crop with weak, slender straw, whilst a thinner plant produces a stiffer straw with better standing properties. This is often obvious on headlands, where for various reasons the plant is often comparatively thin.

The results are so marked that it would probably pay farmers on land where laying is frequent to determine experimentally the best seed rate, or even to sow at the normal rate and thin the crop down in the early spring.

One correspondent, in discussing the laying of the oat crop, stated that a mixture of varieties stood better than a pure crop. With oats, if required only for home consumption, the practice, if found satisfactory, might be used generally. It would be impossible, however, to produce good malting barley or wheat which would sell at average prices from a mixture of varieties. A better plan would be to adopt the practice of growing a mixture of grain and beans, the latter forming only a small percentage of the crop as the stiff stems are only required here and there as supports. On threshing, the mixture can be separated almost completely into its component parts.

No conclusive evidence was brought forward to show that any artificial manures except phosphates have any value as

straw stiffeners, though both lime and salt were said to have some effect in this direction.

Feeding off the crop with sheep during March and April was frequently recommended as a method for preventing it from becoming laid. It also has the advantage of consolidating the surface where soils are exceptionally light. The grazing probably diminishes the yield per acre, but in view of the fact that grazed crops have been known to yield over 9 quarters per acre,* the loss is not too great to be faced when a standing crop is ensured.

The fact is generally recognised that different varieties of wheat, barley and oats differ considerably in their liability to become laid. The subject has been investigated tentatively but no comprehensive tests have been carried on over a sufficient period to provide conclusive results. With the object of supplementing what information there is in existence on the subject, the name of the variety of wheat, barley or oats, on which the account of the laid crop was based was asked for in the schedule.

Several who replied gave additional information regarding the standing power of varieties, and this, together with the results of variety trials on wheat in Herefordshire and on oats in Northumberland, have been drawn upon in the following summary :—

The barleys, as a whole, have poor-standing straws, and none of the varieties cultivated in this country can be relied upon to stand up against a storm which would leave a wheat crop unharmed. But appreciable differences in straw strength exist amongst them. The narrow-eared Chevalier types, as a class, possess the weakest straw of any. The straw of the broad-eared Goldthorpe types is better, but most of the varieties suffer from the defect that the top joint of the straw is apt to break when the crop is dead-ripe, with the result that a considerable percentage of the ears drops off. Archer's Stiff-straw barley has much the same standing capacity as the Goldthorpe types, without the drawback of liability to "necking." In the Sprat barleys the straw is still stiffer, though unfortunately this good feature is associated with a coarseness of the grain which too often spoils it for malting purposes.

The best straws in the group appear to be found in certain hybrids of Archer's Stiff-straw barley and a Swedish broad-eared barley, Plumage. These hybrids are known as Archplume

* See this *Journal*, January, 1919, p. 1163.

and Plumage Archer barleys. The straws of Binder and Maltster are also fairly satisfactory.

In the oat crop there are very marked differences in the straw characteristics, and there seems to be every gradation from the thin-strawed types, grown where straw is especially important for feeding purposes, to the thick reed-like straws of such a variety as Storm King. The thickness of the straw, however, is not an accurate index of its standing capacity.

The replies to the schedule mention a considerable number of varieties with good straw characteristics, but in the absence of comparative trials it is impossible to put them in order of merit. Yelder is noted from Cockle Park as the best standing variety grown there, whilst Victory and Banner have stood "moderately well." Black Tartarian, Storm King, and Abundance are mentioned as satisfactory in several reports. Blainslie, Sandy, and Tam Finlay are, on the other hand, poor standers.

The straw of the various sorts of wheat grown in this country is on the whole better, from the point of view of withstanding rough weather, than that of either barley or oats. There is no variety cultivated on an extensive scale in which it can be described as "bad," and most varieties can be safely described as "moderately good" in this respect. Again, comparative trials under conditions where the lodging of the crop is almost inevitable are wanting, so that it is impossible to place the best standing varieties in order of merit. If a choice is made, however, from amongst the varieties Stand Up White, Browick, Iron (Swedish), Fenman and Yeoman, the chances of the crop "going down" will be reduced to the minimum. Other varieties with a sufficiently good straw to withstand anything except extremely suitable conditions for laying are Squarehead's Master, Wilhelmina, and Benefactor.

In the issue of the *Agricultural Gazette of Canada* for February, 1919, is published an account of some tests made on demonstration pig pastures which were formed in New Brunswick during the season of 1918, as a special effort to aid in the production of pork. It was arranged for the demonstrations to take the form of co-operative grazing tests with stock-farmers in the various counties of the Province. Forty-eight demonstration pastures were provided for in thirteen counties, and 245 pigs were

Demonstration
Pig Pastures at
New Brunswick.

grazed. Those taking part in the tests were given a quantity of seed sufficient to sow one acre of ground, and a coil of woven hog fence wire with which to enclose the pigs.

The following forage crops were tested:—

- (a) Rape, 5 lb., sown in rows 26 in. apart.
- (b) Red clover, a year-old stand used as pasture.
- (c) Grain mixture. Oats 2 bush., and barley, $1\frac{1}{2}$ bush.
- (d) Grain mixture. Oats $2\frac{1}{2}$ bush., and peas $1\frac{1}{2}$ bush.
- (e) Grain mixture. Oats $1\frac{1}{2}$ bush., peas 1 bush., and barley $1\frac{1}{2}$ bush.

Mixed clover and timothy seed was furnished to seed down all grain pastures, so that the area could be used as a pig pasture the following spring. All the forage crops tested made good pasture for a part of the summer. Red clover proved the most satisfactory crop under the conditions of the test. Pasturing on clover may begin before the blossoms form, and continue all summer if a rotation of plots is provided and the area not overstocked.

The results of the tests during 1918 indicate that grazing should prove an economical method of feeding growing pigs.

UNDER the provisions of the Cultivation of Lands (Committees) Order, 1919, new Agricultural Executive Committees were to come into office on 1st June, except in those counties where a later date has been fixed by the Board.

**Constitution and
Functions
of the Agricultural
Executive Com-
mittees.**

Two-thirds of the members of the new Committees have been appointed by the County Councils and the remaining third by the Board, and in selecting their nominees the Board have endeavoured to secure that the various agricultural interests are adequately represented, and to retain the services of as many as possible of those who have done good work on the old Committees. The Board have also used their power of appointment to secure that each Executive Committee includes at least one woman and one representative of labour. There will be general agreement that women have rendered such admirable service to the industry of agriculture during the War that they have more than earned the recognition of representation on the Agricultural Executive Committees, but the Board feel also that the time has come to combine in one organisation the work of both women and men in agriculture instead of continuing the separate women's organisation which was established for the special emergency of the War. As a first step, therefore, the Board have appointed a woman on

each Agricultural Executive Committee, and the matter is further referred to below in connection with the appointment of sub-committees.

With regard to a representative of labour, the Board feel that the work of the Committees affects so closely the interests of agricultural labourers and small holders that it is most desirable that they should be directly represented on the Committees. Such representation is also a recognition of their position as producers of food, and should tend to create a community of interest between the different classes of agriculturists.

Hitherto the Board's District Commissioners have been appointed members of the Agricultural Executive Committees, but the Board have decided that in future they need not be members of the Committees with power to vote, and that it will be sufficient if they attend the meetings of the Committee as the Board's local representatives authorised to act as liaison officers, but without the power to vote.

Duties of the Committees.—The Committees will continue as agents for the Board to carry on the work which has been done by the original Committees in stimulating food production and enforcing good cultivation. Until the legal termination of the War, *i.e.*, the date when the Peace Treaty is ratified, the Committees will exercise the powers of the Board under the Defence of the Realm Regulations, which were delegated to the original Committees. After the termination of the War the Committees will be authorised to exercise the Board's powers under Part IV. of the Corn Production Act, 1917.

The position of the Committees in the future is also affected by the proposals at present contained in Part IV. of the Land Settlement (Facilities) Bill, which will be included in the Bill for the reconstruction of the Board of Agriculture when it is introduced. If those proposals pass into law there will be established in each county a statutory Agricultural Committee of the County Council to which will stand referred all the agricultural duties of the County Council, including agricultural education if the County Council so desires. The Bill also provides that the powers of the Board, under Part IV. of the Corn Production Act, 1917, and Part II. of the Land Drainage Act, 1918, may be delegated to the Agricultural Committee or a Sub-Committee thereof. The County Council will, therefore, become the authority for all matters affecting agriculture in the county, in place of the present system under which certain matters are dealt with by a Committee respon-

sible solely to the Board. In view of the fact that the Board are closely interested, financially and otherwise, in the work of the Agricultural Committee, the Bill provides that it should be established under a scheme to be approved by the Board, and that one-third of the membership of the Committee and of any sub-committees appointed by it may be appointed by the Board. The number of members of the Agricultural Committee will be regulated by the scheme and no limit is prescribed by the Bill. It is intended that the agricultural Committee should appoint sub-committees to deal with the different branches of its work, and one of the sub-committees will, no doubt, be responsible for the supervision of cultivation in the interests of food production and good husbandry, and will exercise the Board's powers under Part IV. of the Corn Production Act, 1917. It is hoped that the members of this sub-committee will be the persons who have previously been acting as the Agricultural Executive Committee for the county.

It is probable, therefore, that the new Agricultural Executive Committee, which came into office on 1st June, will continue as such till towards the end of this year, when the statutory Agricultural Committee has been established, and that it will thereafter carry on the same work as a sub-committee of the Agricultural Committee of the County Council.

In the meantime the Board look to the Agricultural Executive Committees to maintain and consolidate the results which have been secured by the food production campaign during the War and to make it their business to see that the proper cultivation of the land and the production of the maximum quantity of food is regarded as a duty of the highest importance to the nation as a whole.

Sub-Committees.—The Agricultural Executive Committees will no doubt continue to transact much of their business by special sub-committees, and it may be useful to make the following observations on some of the principal matters for which sub-committees have hitherto been set up.

(a) *Labour.*—In view of the serious shortage of labour for the land that still exists in many parts of the country it is probable that a Labour Sub-Committee will be needed for some time to assist farmers to obtain the additional labour they require. Apart from the control of prisoner labour as long as such labour is available the matters to be dealt with by this Sub-Committee will fall mainly under three headings :—

- (i.) Release from the Colours.

- (ii.) Co-operation with the local Employment Exchanges for the placing of unemployed labour available for the land.
- (iii.) Training and placing of inexperienced ex-Service men who desire to obtain agricultural employment. It has now been decided to ask Agricultural Executive Committees to undertake the vocational (apart from curative) training in agriculture of partially disabled men in addition to able-bodied men.

(b) *Cultivation*.—This sub-committee will presumably have to be retained so long as any substantial number of tractors or horses is being worked by the Committee, but the Board are anxious that the Tractor and Horse Schemes should be closed down as soon as possible, and the implements and machinery disposed of by sale in accordance with the instructions already given.

(c) *Women*.—Up to the present the whole of the work connected with the training, employment and organisation of women on the land has been carried out by separate Women's War Agricultural Committees. As is stated above it is now proposed to combine the two sets of organisations, and provision has been made for the representation of women on the Agricultural Executive Committees. The Board suggest that each Agricultural Executive Committee should establish a special Women's Sub-Committee, and that for this purpose they should take over the existing Women's War Agricultural Committee of the county, which is constituted by a process of election by the Village Registrars and District Representatives. So long as it is decided to continue the Land Army, the present paid officers of the Women's Committee will be required.

(d) *Horticulture*.—In their Circular Letter of the 15th March, the Board asked the County Councils to set up special Horticultural Sub-Committees of the Committees responsible for Agricultural Education, and where it has been reported to the Board that this has been done, the Agricultural Executive Committee have been asked to dissolve their Horticultural Sub-Committee. The Board consider that the time has now come when all the Horticultural Sub-Committees should be definitely brought to an end, and they have, therefore, asked each Agricultural Executive Committee not to sanction any further expenditure in connection with the work of the Horticultural Sub-Committees after the 30th June, except in any county where the Board's approval for some special arrangement is obtained previous to the date mentioned.

The above arrangements for bringing to an end expenditure by the Agricultural Executive Committees upon horticulture

do not apply to work in connection with the Bee Re-stocking Scheme, which the Board recognise will be continued until the end of September.

District Committees.—The District Committees which were set up by the original Agricultural Executive Committees ceased to exist on May 31st, but it appears to the Board that the new Agricultural Executive Committees will find it essential to have the advice and assistance of District Committees if they are to be in a position to exercise any effective control of cultivation. The Board suggest, therefore, that the new Agricultural Executive Committees should proceed at once to appoint District Advisory Committees, and that as far as possible they should endeavour to obtain the services of those men and women who have done useful service on the original District Committees together with any additional members that may be desirable.

Staff and Expenses.—The work of the new Agricultural Executive Committees will require a much smaller staff than has been employed during the War, and special care will be taken to see that no appointments are continued unless they are fully justified by the quantity of work done. As a general rule the Board think that it will be sufficient if there is in each county a Chief Executive Officer with one or more District Executive Officers according to the size of the county, together with a Secretary and a few clerks. The termination of the Tractor and Horse Schemes will dispense with the need for a Tractor Representative and a Horse Officer, and other officers specially engaged for those schemes, and it will not be necessary to retain the post of Clerk to the Supplies Sub-Committee. As has been indicated above the Secretary of the Horticultural Committee should not be retained after 30th June, unless the special sanction of the Board has been given. It may be necessary in some counties to retain the post of Labour Officer for a short period, but in many cases this post could be combined with that of Chief Executive Officer or Secretary. A Finance Officer will be required for a few months longer to complete the collection of sums due under the Tractor and Horse Schemes, but the Secretary should be able to undertake this work after the end of September next.

In many counties Drainage Committees have been established by the Board under Part II. of the Land Drainage Act, 1918, and it is desired that the work of those Committees should be carried on by the same staff as is employed by the Agricultural Executive Committee. If it is considered desirable that a

special Drainage Officer should be engaged, the Board are prepared to sanction such appointments and the cost would be met out of the funds of the Executive Committee. Proposals for the appointment of Drainage Officers are to be submitted to the Board with a statement of the qualifications of the man selected and the salary proposed to be paid.

It is anticipated that the new Committees will consider the question of their staff at an early date, and that they will submit to the Board a complete statement showing the names and proposed salaries of each member of the staff whom they propose to appoint or retain. In making new appointments it is desired that special preference should be given to men who have served in the Naval, Military or Air Forces of the Crown during the War. Committees have also been asked to submit their proposals with regard to any payments proposed to be made to Secretaries of District Committees in future. These officials will obviously have much less work than was the case during the ploughing campaign, and the Board hope that it may be possible to obtain the services of suitable men in each district either voluntarily or for nominal salaries.

In many cases the reduction of staffs will render possible a considerable economy in the cost of office accommodation, and Committees have been asked to bear this in mind and to effect any savings that can be made.

FEW people realise that before the War this country practically supplied the world with certain classes of vegetable seeds, both of the kind grown on the farm, and also the more specialised varieties cultivated by market gardeners. The industry, as it at present exists, is a specialised one, and is in the hands of a comparatively small number of growers, contractors, and wholesale and retail merchants.

Seed-growing Districts.—The principal seed-growing counties are Essex, Lincoln, Cambridge, Huntingdon, Kent, Bedford and Norfolk. Smaller areas are to be found in Lancashire, Suffolk, Sussex, Hereford, Somerset and Anglesey. These counties, however, do not embrace the whole of the suitable soil area where seed crops might be successfully grown. The silts of Lincoln and Norfolk are particularly suitable for this form of husbandry, and fen land has proved suitable for some crops.

The county of Essex has always been famous as a seed-growing area, mainly on account of its low rainfall, early harvests, and the drought-resisting properties of the soil.

Although there are a few independent seed growers who select and grow their own seed and finally dispose of it on the market, the great bulk of the seed crops grown by farmers is contracted for by the large firms who supply the "stock" seed, and arrange with the grower as to the price to be paid them for the roughly-dressed crop in autumn or winter. The "stock" seed is obtained by carefully selecting typical roots or plants and growing them on. The utmost care and labour are taken to discard all plants which show deviation from the true type of the variety. This seed is carefully dressed, tested, and sent out to growers when contracts have been arranged. In the case of mangolds, swedes, and many of the Brassica family, the stock seed is sown about mid-season, and transplanted in autumn or early spring; a closer plant is thus obtained, and usually a heavier crop of seed.

Inspection of Crops While Growing. — The large wholesale houses which contract, as well as the private growers, employ capable men who have had in most cases a life-long experience in the cultivation of crops for seed purposes. These men are known as "Roguers," and one of their most important duties is to watch the growth of the various crops let out to farmers, and to remove all plants in the crops which are not true to type and which, if allowed to mature seed, would lower the standard of quality in the bulk sample. The Roguers are also able to give advice as to the best methods of harvesting, extracting, and dressing, and this advice is of the greatest service to farmers or small holders who may be growing seed crops for the first time.

Danger of Cross Pollination. — The advice given during the War to allotment and other small holders to save their own seed was very unsound, as seed crops cultivated in such holdings are readily cross-pollinated by others of the same family which may be growing in close proximity. This is particularly true of the Brassica tribe, which usually produces an abundance of pollen which is readily carried by insects and the wind for considerable distances.

Different varieties of cabbage, kale, and turnip should be separated by at least half a mile to ensure purity of the strains. Unless small growers are prepared to grow sufficient quantities to ensure a paying return, it is much better to leave

seed-growing to farmers and men who have made the subject their vocation. There are, on the other hand, several kinds of vegetable crops which might be grown profitably by the small holder who can afford to wait over a season for returns.

In cases where it is desired to obtain seed quickly, or where autumn transplants have failed, the practice has sometimes been to drill direct and harvest the same season, but the transplanting method is the most generally practised and gives the best results.

Swede, mangold, carrot, parsnip, beet, onion and members of the cabbage family are quite suitable for culture by small holders, provided sufficient isolation is obtained, but this might present difficulties on colonies of small holders closely grouped together.

Harvesting of Seed.—This is a most important operation, as the crops must be taken at the right time and not be allowed to get overripe, otherwise quantities of the seed are lost through dropping.

Several vegetable seed crops have to be harvested at two operations, as for instance, parsnips. The terminal heads (umbels), or to use the trade expression, the King Heads, ripen first, and are usually removed by women and are bagged, while the lateral heads are allowed to ripen on the plant, which is cut over at a later date, and stacked or brought under cover, pending threshing out during the winter. In the case of parsnips this threshing is a very simple operation, as the seed falls out very readily, and the heads can be finally cleaned out by beating with a stick or mallet.

Home-Grown Seed Superior to Foreign Seed.—Most large market gardeners prefer home-grown seed, and several of the largest Bedfordshire growers save their own seed. This is particularly true of onions, and the Bedford men who grow this crop have found by experience that this practice is to their advantage.

Foreign-grown onion seed usually gives a higher germination than English seed, but in the final crop the tonnage per acre is in the majority of cases much heavier where home-grown seed has been used. This is accounted for by the fact that the bulbs produced from imported seed are usually smaller than those obtained from home-saved seed.

Last season (1918) the Food Production Department of the Board carried out some experiments with American onion

seed. The varieties tested were Red Wethersfield, Yellow Strassburg, Yellow Flat Danvers and Australian Brown. The tests were made at seven centres, and the weighings seemed to prove that the tonnage per acre was considerably less than an average onion crop grown under commercial conditions in this country.

At one centre (Wisley) a comparison was made with home-grown varieties. One hundred plants were selected from stocks raised under the same conditions and transplanted on the same soil, and treated on equal conditions right through the season. The final weighings were as follows:—

<i>American Varieties</i> (Californian Seed).					
Yellow Flat Danvers	..	..	..	..	27½ lb.
Australian Brown	..	..	..	..	23 „
Yellow Strassburg	..	..	..	..	19 „
Red Wethersfield	..	..	..	..	17 „
<i>Home-grown Varieties.</i>					
Cranston's Excelsior	..	..	..	..	40 lb.
Ailsa Craig	..	..	..	..	47 „

It may of course be argued that the American varieties were pitted against large bulbing types, but at all centres the bulbs produced by the foreign seed were undersized. It should also be mentioned that onion seed from the north of France in pre-war times did not show this disparity.

Under existing conditions there would appear to be considerable possibilities of increasing the area under seed crops in Britain and expanding the export trade.

At present very little literature on the subject is in existence. A small booklet of some 30 pages entitled "Seed Farming in Britain" has recently been compiled by A. J. Macself, and affords an introduction to the subject.* It is styled "A Practical Treatise on the Cultivation of Vegetables for the Production of Seeds," and gives a considerable amount of information on the general question of seed farming.

THE Canadian Water Weed or Water Thyme (*Elodea canadensis*) was introduced from North America into the British Isles in 1836, and within the next fifteen years had spread and increased to such an extent that it became a serious nuisance to navigation and drainage.

According to records collected by Mr. A. O. Walker, F.L.S., and published by him in the Proceedings of the Linnean Society

* "Seed Farming in Britain."—Hortus Printing Company, Ltd., Burnley, 1919, 2s. 6d.

for 1911-1912, pp. 71-77, the plant is not now increasing in the British Isles, and appears to be on the wane in many parts. It is, however, often still sufficiently abundant to form a prominent feature of the aquatic vegetation in ponds, ditches, lakes, rivers and canals, and the results of an investigation of the food value of the plant recently carried out in Holland may, therefore, be considered of practical importance. Experiments showed that the plant may well be used as cattle and pig food. Since *Elodea* is at its best in summer, when a sufficient supply of other green fodder is usually available, it would be of greater value to preserve it, and conversion into silage seems the most satisfactory method.

Elodea is an entirely submerged water plant of a clear green colour. The stems are slender, cylindrical, brittle, much branched, and emit roots at the nodes. The leaves are nearly always in groups of threes, the groups being closer together on the young stems and more distant on the older. Each leaf is three to four times as long as it is broad (about $\frac{1}{2}$ in. by $\frac{1}{12}$ in.), and has a very finely-toothed margin. *Elodea* produces male and female flowers on different plants, and, since only plants bearing female flowers are known in Britain, reproduction does not here take place by seeds, but by small buds which become detached from the parent plants, and also by the rejuvenescence of the tips of the old branches. The female flowers have long, slender stalks and reach to the surface of the water.

THE Milk Control Board of the Ministry of Food have recently issued a Memorandum on the national milk supply, the principal features of which are set out below.

**The Milk Supply
of the United
Kingdom.**

The inquiries that have been made lead to the three following main conclusions:—

- (a) The production and consumption of milk and dairy products in Great Britain could be considerably increased to the advantage of the farmer and of the public.
- (b) The quality of the present milk supply is rendered gravely defective—
 - (i.) by the presence in the milking herds of cows suffering from tuberculosis;
 - (ii.) by faulty methods used in the production and handling of milk from the farm to the consumer (including delay in distribution).
- (c) The present system of milk distribution is very uneconomical, and could be so reorganised as to allow at once of a liberal price to the farmer and a fair price to the consumer in certain centres.

It is shown that between the years 1871 and 1914 the population of the United Kingdom rose from 26,100,000 to 41,700,000, an increase of 60 per cent., while during the same period the number of cows and heifers increased by only 40 per cent.; at the same time the value of the imported dairy products rose by 270 per cent.

The memorandum contains a table giving the number of cows per 100 acres of cultivated land in the principal European countries, the figures ranging from 20·9 cows in Belgium to 8·6 in France: the number of cows per 100 acres for the United Kingdom is stated to be 9·4, which is lower than any other European country quoted except France.

From the consumer's point of view there is ample room for an increased production of milk in this country. Medical authorities are of opinion that the consumption of milk by children between the ages of 1 and 5 years could be increased with very great advantage to the health of the population.

An increase in the home production of dairy produce depends partly on greater production on the present basis, and partly on a change in existing forms of agriculture. Probably no factor would make more for increased production than the assurance to the farmer of a market at a fair price for all the milk he can produce. Much could be done by greater attention to the encouragement of good milking strains in cattle and the improvement of feeding methods. The labour question is, however, one of the chief difficulties at present experienced by the farmer. It is sometimes urged that the "plough policy" has tended to lessen milk production. In the opinion of many competent authorities, however, it should lead to greater production.

The memorandum devotes considerable space to consideration of the reasons for the defective quality of the milk supply, and separate sections in this connection deal with (1) disease in milking herds; (2) contamination of milk; (3) milk supplied to 21 London hospitals; (4) contamination on the farm; (5) contamination on the railway; (6) contamination in dealer's hands; (7) contamination in consumer's house; (8) souring of milk; (9) type of churn at present in use; (10) adulteration of milk.

Special attention is drawn to the present defective distribution of the milk supply, and it is pointed out how much wastage of labour, transport, etc., at present exists owing to lack of better organised methods both in distribution and collection.

Part V. of the memorandum sets out some considerations which should affect the general policy of the Government with

regard to the milk supply. It is stated that it would appear to be necessary that the Government should concern itself more closely than it has hitherto done with :—

- (a) The encouragement and improvement of milk production.
- (b) The ultimate elimination from the milking herds of animals suffering from tuberculosis.
- (c) The improvement of methods of collection and distribution.

The main objects to be aimed at seem to be :—

- (a) The improvement of the milking strains in dairy herds, by the development of the Board of Agriculture's Milk Record Scheme, of Bull Societies, and in other ways, and the adoption of more scientific methods of feeding.
- (b) The securing of a fair price to the farmer for his milk.
- (c) The grading of milk according to quality, and the fixing of prices according to grade.
- (d) The better collection of milk, of butter, and, as found practicable, of other dairy products.
- (e) The spread of education and other means of information upon all matters connected with milk production (including labour-saving devices).
- (f) The central tabulation of better statistical records of dairy herds and milk production generally.

It is suggested that the Food Controller, or any other Government Department inheriting his duties, should act on the following main principles :—

(a) Every important consuming centre should draw its milk supplies from the producing area or areas situated nearest to it. This general improvement cannot be secured by any single Order, or by any immediate process, but, given a Central Authority, with full power to direct the distribution of milk as required, there should be little difficulty in gradually improving the distribution of milk on these lines by the exchange between different centres of their present sources of supply. As part of this process, steps should be taken to adjust the winter supplies of different districts more closely to their demands.

(b) Milk intended for liquid consumption in an urban centre should, immediately after milking, be cooled to the lowest available temperature and despatched to that centre direct from the farm. Only where the unhygienic quality of the milk requires it should the milk be passed through a local depot or factory.

(c) The policy as regards depots and factories should be on the following lines :—

- (i.) Country depots should primarily be used only for the conversion of surplus milk into milk products. This may be a seasonal surplus during the flush, or a surplus due to the fact that milk in certain districts is produced too far from the railway to make its use for liquid consumption possible.
- (ii.) Measures should be taken for securing that a reasonable standard is observed in the equipment and the handling of milk in depots.
- (iii.) New depots should only be set up when their establishment complies with the foregoing conditions. As regards existing depots in milk-producing districts close to large consuming

centres, any practicable steps should be taken to transfer manufacture to districts farther afield.

- (iv.) Any practicable steps should be taken to close existing factories or depots when they are, and are likely to remain, superfluous. This does not mean that the output of milk-product factories should be diminished. An increased production of milk should allow of these industries being developed.

(d) The railway companies should be approached with a view to the development of facilities for the collection of milk and milk products by motor services feeding the railways. Special accommodation for milk waiting to be put on rail should be provided at country stations from which milk is consigned in large quantities. The companies should also be asked to secure that any new milk vans are built on the best model that can be devised. Unless the cost is prohibitive, experiments on suitable routes should be made with refrigerated vans.

(e) Organised action should be taken to improve the standard of milk as regards both contamination and adulteration. This should follow upon better price control, and is partly a question of the exercise by the Local Government Board of their powers under the Milk and Dairies (Consolidation) Act.

(f) Organised action should be taken to improve and effect economies in local systems of distribution.

A RETURN has been prepared by the Ministry of Food giving the recommendations of the Travelling Commission in respect of the counties of Somerset, Dorset, Devon and Cornwall, together with a statement of the grounds on which such recommendations were made.

**Memorandum on
the Milk (Summer
Prices) Order, 1919.***

The recommendation of the Travelling Commission, in respect of the above-named counties, was as follows :—

“ We consider that milk can be produced more cheaply in the Counties of Cornwall, Devonshire, Somersetshire, and Dorset, than in the remaining parts of Great Britain. This is due chiefly to climatic conditions. Owing to the earlier summer and milder autumn in these districts it is possible for cows to remain at pasture from 1st April to 1st November, while in summer there is not the same need for concentrated foods as in other parts of the country. Prolonged droughts such as those generally experienced in the eastern counties are practically unknown. We therefore recommend that the price paid to the producer for milk in these counties should be 2d. per gal. lower throughout the year than that paid in the rest of England and Wales.”

The following were the grounds on which the above recommendation was passed :—

(1) The cost of production of milk in Great Britain has always varied to a marked degree according to the different districts, and the fixing of a flat price throughout the country has been found to involve considerable unfairness. The only possible remedy for this unfairness is the fixing of differential rates according to the cost of production.

(2) Conditions in the south-western counties of England are more generally suitable for milk production than in the eastern or northern districts (including Scotland).

* See this *Journal*, May, 1919, p. 198.

(3) The south-western counties have a more equable climate and a more abundant rainfall, with the result that the pasture is richer, and that prolonged droughts such as those experienced in the east of England are practically unknown. It has been urged that the heavier rainfall necessitates an expensive drainage system, but this drainage charge is already allowed for in the rent charged for the land on which it is in operation.

(4) Evidence was adduced to show that the grass season in the north and east of England is often over by the end of July, whereas in the south-western counties the grass usually lasts till the end of October. Evidence was further adduced to the effect that in the south-western counties the cows go out to grass at least a month earlier than in the north midlands, the north-eastern division or in Scotland.

(5) This lengthy grass season involves a reduction in the amount expended on concentrated feeding stuffs during the summer. The cost of foods used in the summer period of 1918 was in Cornwall 2·02*d.* per gal., and in Dorset 2·05*d.* per gal., as compared with 5·63*d.* per gal. in South Wales, 7·57*d.* per gal. in the north-western division, and 6·36*d.* per gal. in Yorkshire.

(6) The south-western district is in the main an exporting area for dairy cattle, and evidence was adduced to the effect that dealers from the north and the midlands are accustomed to visit markets in these four counties in order to purchase cattle. Owing to this fact and to the facts that a comparatively small proportion of the herd is changed annually, and that the animals sold are replaced mainly by home-bred stock, depreciation on dairy cattle is lower in the south-west than in other parts of England. According to the returns received, the figures for depreciation in the months May to December, 1918, were in Cornwall 2·37*d.* per gal., in Dorset 2·62*d.* per gal., in Devonshire 3·53*d.* per gal., whereas in South Wales the figures were 5·29*d.* per gal., and in Yorkshire 4·78*d.* per gal., and in the North Midland District 4·98*d.* per gal.

(7) Farmers in these counties do not as a rule endeavour to obtain an equal supply of milk all the year round, but go in largely for the production of summer milk, a system of management which renders milk production much less costly.

The following figures show the production of milk in gallons in the weeks ending 2nd June and 7th December, 1918, in certain representative counties :—

		<i>Week ending 7th Dec., 1918.</i>			<i>Week ending 7th June, 1918.</i>
		<i>Gallons.</i>			<i>Gallons.</i>
Lancashire	..	729,872	..		779,884
Northampton	..	166,931	..		164,668
Derby	.. ..	489,499	..		451,495
Norfolk	.. ..	223,089	..		245,977
Bucks	.. ..	210,554	..		229,235
Kent	.. ..	237,907	..		252,573
Hertford	.. ..	117,863	..		142,615
Oxford	.. ..	109,097	..		151,416
Cornwall	.. ..	298,653	..		446,913
Devon	.. ..	461,059	..		671,184
Dorset	.. ..	318,854	..		507,214
Somerset	.. ..	553,177	..		1,070,515

It will be seen that the difference between the amounts produced in the two periods is considerably greater in the four south-western counties than in any of the other districts quoted.

(8) Though the argument that Devon and Guernsey cows give richer milk and a proportionately lower yield has some weight with regard to the amount of milk which is sold whole, a large part of the milk produced in the south-western counties is made either into cream or into cheese, and in these cases the farmer has the benefit of the quality of the milk in a larger yield of cheese or cream.

Land Cultivation.—In reply to Mr. Cautley, the Parliamentary Secretary to the Board stated that there is no general Order in existence prohibiting occupiers from sowing down arable land to permanent grass. The Agricultural Executive Committees have been instructed that farmers should be allowed complete freedom of cultivation subject to compliance with the rules of good husbandry. (15th May, 1919).

Land Settlement.—In reply to Dr. Macnamara, the Parliamentary Secretary to the Board of Agriculture issued the following statement respecting land purchased or agreed to be purchased by County Councils with the Board's approval since 1st January, 1919, for land settlement :—

					<i>Total Area of Land Purchased.</i>	<i>Average Price per Acre.</i>
					<i>Acres.</i>	<i>£</i>
England :						
Bedfordshire	..	..	..	..	629	58
Cambridgeshire	..	..	..	..	186	33
Cheshire	..	..	..	..	2,628	48
Cornwall	..	..	..	..	669	27
Devon	..	..	..	..	377	37
Essex	..	..	..	..	360	53
Gloucester	..	..	..	..	312	49
Hereford	..	..	..	..	2*	325*
Hertford	..	..	..	..	79	33
Isle of Ely	..	..	..	..	916	83
Kent	..	..	..	..	301	28
Lancashire	..	..	..	..	539	51
Lincs (Lindsey)	..	..	..	..	477	67
Norfolk	..	..	..	..	706	28
Northumberland	..	..	..	..	1,873	13
Salop	..	..	..	..	471	36
Somerset	..	..	..	..	2,588	47
Suffolk, West	..	..	..	..	703	27
Sussex, East	..	..	..	..	344	43
" West	..	..	..	..	335	40
Warwick	..	..	..	..	588	36
Worcester	..	..	..	..	240	58

* This holding comprised a house, 2 acres of orchard and fruit trees, and bushes in full bearing.

				<i>Total Area of Land Purchased. Acres.</i>	<i>Average Price per Acre. £</i>
Yorks, East Riding .. ..	..	..	..	478	49
„ North Riding .. ..	..	..	..	565	42
„ West Riding .. ..	..	..	..	1,929	52
Total—England .. ..	..	..	..	18,295	£44
Wales :					
Anglesey .. ..	..	..	..	1,147	39
Carnarvon .. ..	..	..	..	66	41
Flint .. ..	..	..	..	343	28
Monmouth .. ..	..	..	..	163	22
Total—Wales .. ..	..	..	..	1,719	£35
Total—England and Wales ..	..	..	..	20,014	£43

(19th May, 1919.)

Speculation in Land.—In reply to Mr. Hurd, the Parliamentary Secretary to the Board stated that the Board were aware of the feeling of disturbance which was being caused in many parts of the country by the operations of land speculators, and if these operations were prejudicial to the proper cultivation of the land action would be taken under the Board's powers under the Defence of the Realm Regulations. He stated that it may be necessary, however, to consider whether special legislation would not be necessary in order to deal with the matter. (2nd June, 1919.)

Harvest Labour.—In reply to Mr. Clough, the Parliamentary Secretary to the Board stated that the Board had communicated with the Ministry of Labour with a view to farmers being supplied promptly with the labour they will require at harvest time, and that the county Agricultural Executive Committees had been asked to assist the Employment Exchanges in supplying the labour required. (3rd June, 1919.)

Income Tax.—In reply to Sir Richard Winfrey, the Chancellor of the Exchequer stated that the numbers of farmers who elected to be assessed under Schedule D for the years 1915-19 are approximately as follows :—

Year 1915-16 .. ..	..	..	1,259
„ 1916-17 .. ..	..	..	1,500
„ 1917-18 .. ..	..	..	1,500
„ 1918-19 .. ..	..	..	2,700

(26th May, 1919.)

Royal Agricultural Show and Entertainments Duty.—In reply to Sir James Cory as to liability for Entertainments Duty for the use of a band at the Annual Show of the Royal Agricultural Society, the Chancellor of the Exchequer stated that he was informed that the Board of Customs and Excise have exempted from Entertainments Duty payments for admission to the Annual Show of the Royal Agricultural Society on certain conditions, one of which was that the proceedings do not include a band, and that he was in agreement with this decision. He added that the provisions of the law had already been stretched to their utmost limit in favour of agricultural shows, and that he was unable to make any further concession. (19th May, 1919.)

OFFICIAL NOTICES AND CIRCULARS.

N.B.—The Orders which may be mentioned in this section of the JOURNAL may usually be obtained at the price of 1d. each from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, and 28, Abingdon Street, London, S.W. 1; 37, Peter Street, Manchester, and 1, St. Andrew's Crescent, Cardiff.

THE following Circular Letter was addressed to County Agricultural Executive Committees by the Board on 14th May :—

SIR,—1. I am directed by the President of the Board of Agriculture and Fisheries to say, for the information of your Committee dealing with the local administration of the above-mentioned Scheme,* that the Board have had under review the general progress made under the Scheme, and various points in connection with its administration during the period of about three months that the scheme has been in effective operation.

2. **General Progress.**—The following statement shows the progress made :—

	<i>Total.</i>
Applications refused by the Board, without reference to County Committees, as obviously ineligible..	30
Applications referred by Board to 58 County Committees :—	
Demobilised Officers	801
Non-demobilised Officers	589
	1,390
" Officer pupils " started training in 39 counties . .	264
" Provisionally " approved (in addition) by County Committees	307
" Officer pupils " left training in 2 counties . .	2
Applications refused by County Committees . .	130
Applications withdrawn by applicants	92
Applications outstanding for interviews, etc., by County Committees	595

3. **Interviews with Candidates.**—The Board are much indebted to County Committees for the progress made under the Scheme which the Board consider, on the whole, to be very satisfactory, but they feel that in certain counties much more can be done by the Committee concerned to expedite the interviewing of candidates—particularly those who have already been demobilised or released from the Forces and who desire a decision on their applications at the earliest possible moment in order that if they are not accepted for agricultural training they may be able to make other arrangements for resettling in civil life. The Board would make the following suggestions in this connection for the consideration of County Committees :—

- (i.) Interviews with candidates should be arranged for at more frequent intervals (weekly, if possible).
- (ii.) Delegation of powers for this purpose by County Committees to, say, (the County Agricultural Organiser and one or more members of the Committee.

* The Scheme for Agricultural Training of Officers.

- (iii.) Arrangements for interviewing candidates should be made by the Committee *direct* with the candidate instead of through the District Director of the Ministry of Labour, as originally arranged.
- (iv.) Arrangements should be made with neighbouring counties that in the event of no suitable farmer being available in the particular county in which the candidate desires to be trained, the neighbouring county will take over the application—if the applicant agrees. The Board should be notified of every case in which an application is dealt with in this manner.

4. Selection of Applicants.—The following are amongst points upon which various Committees have asked the Board's advice as to whether grants should be made, and it may be convenient, therefore, that the Board should in this letter set out their opinion on each such point :—

(i.) *Candidates with no Capital or insufficient Capital to start Farming.*—The fact that an applicant has no capital should not render him ineligible for training under the Scheme. It will be quite appropriate for a Committee to arrange for the training of a candidate who can qualify as a bailiff or manager of a large farm or small estate, provided the Committee are satisfied that he is the right type of candidate for this particular class of work. Really suitable cases of the kind may be rare, but they do occasionally occur amongst candidates under the Scheme; and a position of the nature referred to opens an avenue into agricultural life for a good candidate who has no capital or capital insufficient to start farming on his own account.

(ii.) *Candidates proposing to go Abroad on Completion of Training.*—The fact that a candidate proposes to go abroad at the completion of his training should not exclude him from consideration under the Scheme, but the Board consider that it is reasonable that preference should be given under the Scheme to candidates who are going to settle in the Home Country. As a general rule, the man who is going to farm abroad would be well advised, for obvious reasons, to obtain his training where he is going to farm.

(iii.) *Training with near Relatives.*—A candidate should not be placed for training under the Scheme with a near relative. If a candidate has a near relative able and willing to train him the Board do not consider that any grant to him can be justified out of public funds.

(iv.) *Candidates who have started Training on their own Account with a Farmer before any Grant is made.*—Where an applicant has already started training of his own accord with a particular farmer and applies for a grant, the Board offer no objection to such a grant being made—after receipt of the formal application by the Committee from the Board—provided that the Committee are entirely satisfied that both the applicant and the farmer are suitable. But the Board think that in any such case special inquiry should be made into the financial position of the applicant before a grant is awarded, inasmuch as the presumption is that the applicant, having already bound himself to a farmer, does not require Government financial aid for training. Where, however, the Committee are satisfied on the points mentioned, a grant can be paid to the candidate as from the date on which the candidate is actually "approved" by the Committee. Should the Committee consider that, in any individual case, hardship would be involved by the

candidate not receiving a grant from the date on which he actually started training instead of from the date of approval, the Board would be prepared to reconsider the point, on receipt of full particulars.

(v.) *Financial Position of Candidates.*—The decision as to whether the financial position of an applicant justifies a grant being made to him for training is one which is left by the Board to each County Committee, to decide. In many cases a County Committee will have before them when interviewing a candidate, the Ministry of Labour Form—DIAD-1—giving particulars of the candidate's financial position, but where such form is not available at the time of interview the Committee can, without awaiting such particulars, arrange for the training of the applicant if they are entirely satisfied by their interview with the candidate that he cannot carry out training without Government assistance. It must be borne in mind in this connection that a candidate who wishes to farm at the completion of his training will require to conserve capital for this purpose.

5. *Wife's Allowance.*—It has been decided that an allowance at the rate of £25 per annum may be made to each married "Officer pupil" whilst in training under the Scheme, in addition to the existing maintenance and children's allowances. This wife's "allowance" should be paid by County Committees to "Officer pupils" already in training, as from the date on which they started training or from the date of marriage, whichever is the later.

6. *Children's Allowance.*—The existing proviso that an "Officer pupil" must have been married before the date of the Armistice (11th November, 1918) in order to qualify for an allowance in respect of his children has now been waived, but no allowances should be paid in future as regards children unless the "Officer pupil" first furnishes to the Committee a birth certificate in respect of each child for whom he claims an allowance, and also evidence in writing, to the satisfaction of the Committee, showing that the child is still alive. Such evidence should usually be in the form of a written statement from two householders. Similar evidence must be furnished quarterly thereafter.

No "children's allowance" should normally be paid in respect of any illegitimate child, but the Board would be prepared to consider whether this allowance can be paid in any individual case in which this rule may involve hardship, *e.g.*, where the illegitimate child is being brought up as part of the "Officer pupil's" own household.

7. *Revised Forms.*—I am to enclose copies of revised Forms* O.A.T.S. 1 (Notes as to Procedure) and O.A.T.S. 2 (Regulations as to Maintenance and Children's Allowances). These forms supersede the existing forms which should no longer be used. Further copies of the new forms will be supplied by the Board as and when desired.

8. *Agricultural Education and general Supervision of Officer Pupils whilst in Training.*—The Board trust that arrangements are being made by your Committee for frequent visits to "Officer pupils" whilst in training, in order to ensure that such pupils are in fact being properly trained by the farmers with whom they have been placed, and are making good progress with their training. In counties in which a number of "Officer pupils" are in training, special agricultural courses for them

might with advantage be started at convenient centres by County Education Committees. The Board hope to communicate hereafter with you on this last point, to which they attach much importance.

I am, etc.,

(Signed) H. E. DALE,

Assistant Secretary.

A CENTRE for the instruction of ex-soldiers and sailors in fruit and vegetable growing has been established by the Board of Agriculture at Shippea Hill near Lakenheath, Suffolk, where 25 men are already undergoing training. **Fruit-growing for Ex-Service Men.** This centre is to provide for one of the Board's short courses of practical tuition in agriculture designed for the benefit of inexperienced ex-Service men who wish to work on the land as wage-earners.

The next course begins on 7th July, and will last eight weeks. Applications from discharged or demobilised men desiring to attend it should be addressed to the Secretary, Board of Agriculture, 72, Victoria Street, London, S.W. 1. Pupils will receive allowances during their training, extra provision being made for married men.

• Six estates have been acquired by the Board on lease or by purchase and one estate has been presented to the Board as a free gift by its owner, Mr. Buchanan, in connection with the settlement of ex-service men on the land.

Farm Settlements.

The Patrington estate, near Hull, consisting of 2,866 acres, is held from the Crown on 99 years' lease at an annual rental of £4,027. Holbeach, in the Holland Division of Lincolnshire, 1,002 acres in extent, is held from the Crown on a 99 years' lease at a rental of £1,023. Heath Hill, in Shropshire, consisting of 1,150 acres, was bought at just under £35 an acre for the land and 30 cottages. Pembrey, in Carmarthenshire, 1,345 acres, cost about £22 an acre. A Nottinghamshire estate, at Rolleston, of 2,700 acres, was bought for £47,750. A Wiltshire estate, of 2,359 acres, at Amesbury, was acquired for the sum of £7,500, plus a rent-charge of £1,375. The estate given to the Board is at Bosbury, in Herefordshire. Including this generous present the estates held for colonies or settlements by the Board comprise 12,778 acres.

Only the Patrington and the Holbeach estates have been in the possession of the Board long enough to enable adequate statements of account concerning their working to be drawn up. At Patrington 34 cottages have been built and two more are approaching completion. Other cottages have been repaired and roads made. The estate has been farmed as a unit, and the land being heavy warp, corn has been largely grown. A net profit of £11,685 has been made in the past year and a half.

Holbeach will be eventually divided into 10-acre small holdings, each of which should support in comfort a small holder and his family. Farmed as a unit this land has earned a profit to the Board of £7,282. Although the Board have not yet developed the Heath Hill estate to a point at which satisfactory accounting is possible, it is suitable for dairying and market gardening on small-holding.

lines ; and the outlook for Pembrey is also regarded as favourable. The Amesbury land is probably not so good, but it is situated close to one of the biggest military camps in the country, and will, therefore, have not only a fine market at its doors but also liberal supplies of stable manure.

THE reclamation of waste and uncultivated areas is a matter to which the Board are now paying attention. It is not expected that much of this reclamation will be directly economic, especially when the present prices of materials and the fact that it is desired to use labour that would otherwise be unemployed are taken into consideration.

Reclamation of Waste Land.

Several indirect advantages to the State, however, may be expected to accrue. Such labour utilised for productive work reduces the total amount payable for unemployment benefit ; any addition to the total area of cultivated land of the country is of advantage both as regards food production and from the social point of view ; and even if the cost of reclamation considerably exceeds the value of land when reclaimed, the country in suitable cases would still be the gainer, for account must be taken not only of the rent obtainable, but also of the gross value of the total produce and services (affecting landlord, farmer, labourers, agricultural merchants, retailers and transport services) arising from the land in question.

A beginning is being made on the Wash, where the potential fertility of the marshes outside the sea wall is well known. The foreshore rights and the area outside the existing sea wall are being acquired along a stretch of about 15 miles of the north-west coast. All this land is not yet suitable for immediate reclamation, but the acquisition of the various rights of frontagers and the Crown by one body will remove for the future the great legal difficulties which have so much hampered any reclamation work in the past.

The approximate area of foreshore proposed for reclamation (from existing sea wall to high water of ordinary tides) is 2,980 acres. Of this area, it is only intended to enclose for the present about 1,500 acres in four separate areas. Some preliminary work may be done on the remaining stretches to bring about a more speedy filling up of creeks and accretion of deposit.

In view of the present shortage of agricultural workers, every possible precaution is being taken to guard against the diversion to reclamation work of labour suitable for the farms.

THE following Circular Letter (Ref. No. C.L. 158/C. 6) was addressed to the London County Council and to the Councils of County Boroughs and Urban Districts in England and Wales by the Board on 23rd May :—

Tenure of War Allotments.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to the Board's Circular Letter of the 21st February last (C. L. 122/G. 2),* and to say that, in view of the number of cases which Local Authorities

are submitting to the Board with regard to continuing possession of land acquired for war-time allotments, the Board think it desirable to send you the following statement of their policy in regard to this matter.

2. While the retention of land as allotments cannot be permitted to restrict the development of a town, or to prevent the erection of houses, factories, works, etc., the Board consider that no land cultivated as allotments should be given up for building purposes until immediately before building operations begin. Authorities should, therefore, satisfy themselves that the plans of buildings have been approved by the Local Authority, and that the building material is available to commence the work. A Council should also notify applications for possession that if building operations do not commence within one month of the date from which possession is given the Council will have to consider whether they should not exercise their compulsory powers for the acquisition of the land.

3. In cases where the owner proposes to sell the property either by private treaty or public auction, or to lease it, he often desires to resume possession for the purpose, and in some cases owners have stated that they were prepared to continue to cultivate the land pending its disposal. In such cases Councils should give a written undertaking to the owner that if the property is sold or agreed to be leased they will be prepared to give up possession to the purchaser or person entitled to the agreement as soon as he requires immediate possession of the land for building or industrial purposes, subject to the safeguards outlined in the preceding paragraph.

4. I am to take this opportunity of saying that if your Council have not yet furnished the Board with particulars of the results of the negotiations entered into by your Council for the continuance in possession of any land acquired for allotments under the Defence of the Realm Regulation 21, the Board would be obliged if the matter could receive early attention.

I am, etc.,

(Signed) A. D. HALL,
Secretary.

THE Food Controller has issued a General Licence (No. 577), dated 12th May, 1919, under the Grain (Prices) Order, 1918,* authorising retailers to add $\frac{1}{2}d.$ per lb. to the price of rye, barley, and oats permitted by the Principal Order, where the quantity sold in any week to one purchaser does not exceed 28 lb.

**Increased Retail
Prices of Rye, Barley
and Oats.**

THE Food Controller announces that in the case of any potatoes remaining in the hands of the grower on 30th June, the grower may at once send in his claim to the Food Controller for payment in respect of the undelivered balance of his crop, and such sum as is properly due to the grower in respect of these potatoes, after deducting the estimated cost of dressing and delivery, will be paid as soon as it can be ascertained.

**Claims in Respect of
Surplus Potatoes,
1918 Crop.**

* Printed in this *Journal*, September, 1918, p. 742.

Growers in Great Britain who have sound potatoes on hand on 30th June, should, therefore, write to the Divisional Food Commissioner for the necessary form of claim, on which they should state the quantity of sound ware and sound undersized potatoes, respectively, remaining on the farm. This information should be given as soon as possible, in any case not later than 6th July, in order that the quantities may be verified.

THE Board of Agriculture and Fisheries are prepared to arrange for the inspection of crops of potatoes of varieties immune from Wart Disease on application in writing from growers in England and Wales in districts regarded by the Board as suitable for the production of "seed." This arrangement will apply only to growers whose area under any one variety is not less than $\frac{1}{2}$ acre. Where after inspection the Board are satisfied that the stock is pure and the general condition of the crop satisfactory, a certificate to that effect will be issued to the grower.

**Wart Disease of
Potatoes:
Free Inspection of
Growing Crops of
Immune Varieties.**

The object of the inspection is to secure as far as possible that pure "seed" true to type shall be available for planting in 1920 in areas certified as Infected Areas under the Wart Diseases of Potatoes Order of 1918.* It must be remembered that under this Order "seed" of immune varieties can be sold only to dealers or under licence. The Board are not prepared to issue a licence until they are satisfied that the stock is pure and the general condition of the crop satisfactory. The possession of a certificate will assist the grower to sell his "seed" to a dealer and will facilitate the issue of licences for sale to individual growers.

Applications for the inspection of growing crops must be made on forms provided for the purpose, which can be obtained from the Board of Agriculture and Fisheries, Commercial Division, 72, Victoria Street, London, S.W. 1. These forms, duly completed, must be returned to the above address not later than the 15th July, 1919.

THE Fertiliser Prices Order,† which governed the maximum prices of fertilisers from 1st June, 1918, to 31st May, 1919, ceased to have effect from 31st May, 1919. The Board of Agriculture and Fisheries have, however, come to an agreement with the makers of Sulphate of Ammonia and Ground Basic Slag with regard to the maximum prices to be charged for these two fertilisers.

**Prices of Sulphate
of Ammonia and
Ground Basic Slag,
1919-20.**

Sulphate of Ammonia.

Agreed Maximum Prices.—It has not yet been possible to arrange prices for the whole season, but the Sulphate of Ammonia manufacturers have agreed :—

- (a) To provide 5,000 tons of Sulphate of Ammonia ($24\frac{1}{2}$ per cent.) for direct application to the land during the period 1st June to 30th September, 1919, in lots of not less than 2 tons, at £17

* See this *Journal*, May, 1918, pp. 211 and 212; and February, 1919, p. 1372.

† See this *Journal*, May, 1918, pp. 220-221, and June, 1918, p. 359.

per ton (less a trade discount to agricultural merchants, dealers and co-operative societies). This price to include delivery by rail or water to purchaser's nearest railway station or wharf in Great Britain, or, in the case of deliveries to Ireland, delivery f.o.b. port in Great Britain.

- (b) To provide 35,000 tons for delivery to manure mixers and makers of compound fertilisers during the period 1st June to 30th September.

Orders for delivery are to be sent by buyers to the Sulphate of Ammonia Association, 84, Horseferry Road, S.W. 1, where their orders will be allocated among individual makers.

Conditions of Sale.—(1) The agreed maximum prices are net cash prices for deliveries in lots of 2 tons and over in maker's bags, net weight excluding weight of bags. Where credit is given to the purchaser, a reasonable extra charge may be made, provided that the discount for net cash is quoted on the invoice, and is such as to bring the net cash price within the agreed maximum price. If purchaser's bags or other packages are used, reasonable allowance shall be made to the purchaser. Where 1 ton or upwards is sold for delivery in bags containing less than 2 cwt. each, a reasonable extra charge may be made beyond the agreed maximum prices which would otherwise have been charged.

(2) For deliveries in lots of less than 2 tons the agreed prices shall increase as under :—

<i>Quantity Delivered.</i>				<i>Additional Price authorised.</i>	
				<i>s.</i>	<i>d.</i>
1 ton and over	..	..	..	10	0 per ton.
2 cwt. and over but less than 1 ton	..	..	..	1	0 per cwt.
1 "	"	"	2 cwt.	2	0 "
28 lb.	"	"	1 "	3	0 "
14 "	"	"	28 lb.	4	0 "

(3) For Sulphate of Ammonia containing more than $24\frac{1}{2}$ per cent. by weight of Ammonia, the agreed maximum prices shall be increased by 4s. per ton for each complete one-fourth of 1 per cent. (calculated on the total weight of the Sulphate of Ammonia) by which the Ammonia contents are more than $24\frac{1}{2}$ per cent., whilst for Sulphate of Ammonia containing less than $24\frac{1}{2}$ per cent. by weight of Ammonia, the above agreed maximum prices shall be reduced by 4s. per ton for each one-fourth of 1 per cent. or fraction of one-fourth of 1 per cent. (calculated as aforesaid) by which the Ammonia contents are less than $24\frac{1}{2}$ per cent.

(4) For Sulphate of Ammonia containing less than 0.025 per cent. of free acid, an additional charge at the rate of 5s. per ton may be made by the vendor, provided that the invoice given by the vendor to the purchaser states such additional charge separately, and contains a guarantee by the vendor that the free acid contained in the Sulphate does not exceed 0.025 per cent.

(5) For Sulphate of Ammonia which is specially ground or pulverised at the request of the purchaser, an extra charge (not exceeding 5s. per ton) may be made for special grinding, provided that such extra charge is separately stated on the invoice given to the purchaser as aforesaid.

(6) The above increases or reductions in the agreed maximum prices chargeable shall not apply to any delivery of less than 2 cwt. of Sulphate of Ammonia.

Ground Basic Slag.

Agreed Maximum Prices.—The following prices are the agreed maximum net cash prices for Ground Basic Slag in maker's 2-cwt. bags, delivered in *minimum lots of 4 tons* in railway truck, or free *ex* barge or ship at purchaser's or consumer's railway station or wharf in Great Britain, or, in the case of shipments to Ireland, the Channel Islands or the Isle of Man, free on board at port of shipment in Great Britain :—

Percentage (calculated in terms of tri-basic Phosphate of Lime) of total Phosphates.					Price per ton.	
12 per cent. and over, but less than 14 per cent.					s.	d.
12	per cent.	and over,	but less than	14 per cent.	..	62 0
14	"	"	"	16	"	64 0
16	"	"	"	18	"	66 0
18	"	"	"	20	"	68 0
20	"	"	"	22	"	70 0
22	"	"	"	24	"	72 0
24	"	"	"	26	"	75 0
26	"	"	"	28	"	78 0
28	"	"	"	30	"	81 0
30	"	"	"	32	"	84 0
32	"	"	"	34	"	87 0
34	"	"	"	36	"	90 0
36	"	"	"	38	"	93 0
38	"	"	"	40	"	96 0
40	"	"	"	42	"	99 0
42	"	"	"	44	"	102 0

The above prices for all qualities are the agreed maximum cash prices for sales of Ground Basic Slag for delivery between 1st September, 1919, and the 28th February, 1920. In the case of sales of Ground Basic Slag for delivery during other periods, the maximum prices for all qualities will be less than the prices set out above, in accordance with the following table, namely :—

Reduction in the agreed Maximum Prices set out above.					s. d.	
Period of Delivery.					s. d.	
During June, 1919	..	..	..	..	4 0	per ton.
" July, "	..	..	..	..	3 0	"
" August, "	..	..	..	..	2 0	"
From 1st September, 1919, to 28th February,						
1920	..	..	..	..	Nil	
During March, 1920	..	..	..	..	2 0	"
" April, "	..	..	..	..	3 0	"
" May, "	..	..	..	..	4 0	"

Orders for delivery at these prices should be placed with the Basic Slag makers as soon as possible.

General Conditions.—(1) The maximum prices are net cash prices for Ground Basic Slag in maker's bags, net weight excluding weight of bags. Where credit is given to the purchaser, a reasonable extra charge may be made, provided that the discount allowed for net cash is quoted on the invoice, and is such as to bring the net cash price within the agreed maximum price. If purchaser's bags or other packages are used, or the purchaser takes delivery without bags, a

reasonable allowance shall be made to the purchaser. Where 1 ton or upwards is sold for delivery in bags containing less than 2 cwt. each, a reasonable extra charge may be made beyond the agreed maximum prices which would otherwise have been charged.

(2) The above prices for all qualities are for Basic Slag, ground in such a way that at least 80 per cent of the total weight will pass through a sieve containing 10,000 apertures to the square inch. Where Basic Slag is sold less finely ground, an allowance off the above maximum prices shall be made to the purchaser at the rate of 3d. for each 1 per cent. (calculated upon the total weight of the Basic Slag), by which the quantity which will pass through such a sieve as aforesaid is less than 80 per cent., but with an additional allowance at the rate of 9d. for each 1 per cent. (calculated as aforesaid) by which the quantity which will pass through such sieve is less than 75 per cent. An invoice is to be given to each purchaser, stating in every case the percentage of the total weight of Basic Slag delivered which will pass through a sieve containing 10,000 apertures to the square inch.

(3) For Ground Basic Slag, packed in special bags for carriage by sea, an extra charge at the rate of 2s. 6d. per ton may be made.

Superphosphate.

Owing to the varying cost of importing phosphate rock, it has not been possible to arrange for Superphosphate to be sold at a uniform delivered price. During the 1918-19 season, phosphate rock and other materials were supplied to Superphosphate makers by the Government at less than market prices. This assistance has now been discontinued, and the Board are informed by makers that the prices for delivery during the four months 1st June to 30th September, 1919, are likely to be higher than those ruling in 1918-19.

THE Food Controller has issued a General Licence (Order No. 567), under the Seeds, Nuts, Kernels, Oils and Fats (Maximum Prices) Order, 1919,* to the effect that seeds, nuts, kernels, oils or fats, for the time being outside the United Kingdom, may be bought, sold or dealt in free from the restrictions imposed by the Principal Order.

THE Food Controller issued on 21st May, his decision on the points raised by the deputations which he has received on the subject of the prices for milk as fixed in the Milk (Summer Milk, Summer Prices: Prices) Order, 1919.

Deputations to the Food Controller.† In certain of these cases, it is stated, the matter was referred to the Travelling Commission on the Costs of Production of Milk for consideration of further evidence, and a number of representative witnesses were heard. In particular the questions of the differential prices in the counties of Cornwall, Devon, Somerset, and Dorset and of the prices in the industrial area of Lancashire were carefully re-examined in the light of the representations made both to the Food Controller and to the Travelling Commission.

* See this *Journal*, May, 1919, p. 211.

† See this *Journal*, May, 1919, p. 198; also this issue, p. 325.

The Travelling Commission has reported that in the opinion of the Commission no sufficient evidence was brought forward which would justify the Commissioners in departing from their previous recommendations, and the Food Controller, after having considered this report, and given careful regard to the various representations made to the Ministry, decided to make no alteration in the terms of the Milk (Summer Prices) Order.

It is announced in the issue of the *National Food Journal* for 4th June that all British and Irish-made cheese, except Caerphilly, delivered by the maker after 30th June will be free of control. Such cheese intended for the Government pool must be delivered to the station, premises or warehouse of the Government factor on or before that date. No cheese delivered later will be purchased or accepted by the Ministry.

**Removal of
Control
of Cheese.**

THE following Notice was issued by the Board on 27th May :—
The Board of Agriculture and Fisheries desire to call the attention of growers and dealers in gooseberries to the fact that Article 4 of the American Gooseberry Mildew (Fruit) Order of 1915 has been cancelled by the American Gooseberry Mildew (Importation of Fruit) Order of 1916, which prohibits the importation of gooseberries from any place outside Great Britain, excepting the Channel Islands. With this exception the Order of 1915 remains in force, and all growers and dealers in gooseberries should take notice of its provisions, and of the fact that they will be strictly enforced. The chief provisions of the Order are :—

**American Gooseberry
Mildew (Fruit)
Order.**

1. Every consignment of gooseberries for sale must carry a label bearing the name and address of the consignor or a distinctive name or mark whereby the consignor can be identified.

2. Every person who consigns gooseberries for sale without attaching a label is liable, on conviction, to a fine not exceeding Ten Pounds, whether the package contains any diseased gooseberries or not. It is not necessary to disclose the name of the consignor if a distinctive name or mark whereby the consignor can be identified is added, but salesmen and fruit sellers are bound to give the name and address of the consignor to any duly authorised Inspector, who may require it in writing under a penalty, on conviction, of Ten Pounds, should any diseased gooseberries be found in the consignment.

3. Any duly authorised Inspector has the power to examine any consignment of gooseberries for sale, and to require any person, having in his possession or under his charge any diseased gooseberries—

(a) To refrain from moving any packages containing diseased gooseberries from the premises where they may then be until the diseased gooseberries are removed therefrom.

(b) To remove all gooseberries from any package in which diseased gooseberries may be found, and forthwith to destroy all those found diseased by fire or other effectual means.

(c) To cleanse thoroughly by washing or other suitable method the package in which diseased gooseberries may be found.

4. Berries which are not badly attacked may be sent by the grower direct to jam manufacturers if packages or containers are either

destroyed or returned direct to grower after treatment with disinfectant or boiling water.

The Board desire to remind gooseberry growers of the fact that American Gooseberry Mildew is a notifiable disease under the 1911 Order, and that growers in whose plantations an outbreak occurs are required immediately to notify the Board of its occurrence.

CONSIDERABLE losses are occasioned annually to farmers by the disease known as epizootic bovine abortion; and the Board of Agriculture for some years past have been devoting a large measure of attention to the question of its treatment. In addition to issuing information on the subject in the form of leaflets, etc., anti-abortion vaccine has been prepared and supplied from the Board's Laboratory for use on many hundreds of farms. During one week in May, for example, about 550 doses were manufactured, packed, and despatched from the Laboratory.

Treatment for Epizootic Bovine Abortion.

Owners of herds can obtain advice or vaccine at any time by applying to the Board of Agriculture's Laboratory, New Haw, Weybridge. Applicants should forward the fullest possible particulars of the case and state them carefully and clearly. All veterinary surgeons practising in rural districts will be well advised to get in touch with the Board on this subject, if they have not already done so, with a view to obtaining such supplies of vaccine as they may require.

There are two methods of dealing with this disease—(1) to pick out and isolate the infected animals; (2) to vaccinate all the cows and heifers *before* they become pregnant. The former method is only possible if the owner is in a position to provide for the complete isolation of the infected stock, and if the proportion of initial infection is not too high. Vaccination is the method recommended for general use. Its aim is artificially to render the animal sufficiently resistant to the disease to enable it to carry a calf to full time notwithstanding its infected environment. If left unvaccinated in the midst of infection, the members of an infected herd as a rule become resistant gradually, and abortion is then confined almost entirely to heifers and other new animals that may be brought in. The development of this condition of resistance, however, usually takes some years, and meanwhile serious losses in calves and milk may be experienced. Vaccination hastens the progress towards a state of comparative immunity.

In certain cases of badly-infected herds, and particularly of pedigree herds, a combination of both methods may be advantageous if two sets of buildings are available. In this event, vaccination might be confined to actual members of the infected herd and those animals which must be housed with them, an attempt being made in the meantime to rear a clean herd from the heifers isolated in the other set of buildings.

The Board of Agriculture warn farmers against the use of unscientific remedies for epizootic bovine abortion. There is no serum which is of any value; and vaccines consisting of dead bacilli have proved useless. Good results can only be expected from exceptionally rich cultures of living bacilli; and the farmer before treating his herd should invariably consult a veterinary surgeon.

A leaflet dealing with this troublesome disease may be obtained on application to the Secretary, Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1.

With reference to a Note which was published on p. 98 of the issue of this *Journal* for April last, that where in the opinion of a person grading any first-grade beast it is likely to yield an unusually small portion of bone the maximum prices for first-grade beasts specified in Part I. of the First Schedule to the Live Stock (Sales) Order, 1918, may be exceeded by a sum of not more than 3s. per cwt. instead of 1s. per cwt. as provided by the Order, the Food Controller announces that the instruction to this effect is cancelled. The price for beasts placed in the first grade can only now be super-graded to the extent of 1s. per cwt.

Super-grade Cattle.*

An account of the outbreaks during 1918 of animal diseases scheduled under the Diseases of Animals Acts, 1894 to 1914, is given in an abbreviated Report recently issued by the Board of Agriculture and Fisheries.† It is stated that there were three outbreaks of *Foot-and-Mouth Disease* during the year, as compared with no outbreak in the previous year. These cases, however, it is explained, were substantially one outbreak. Two hundred and forty-five outbreaks of *Anthrax* occurred, as against 421 in 1917. A slight increase in *Glanders* and *Farcy* is reported, otherwise than amongst army horses, the figures being 34 outbreaks in 1918 and 25 in 1917. *Parasitic Mange* in horses owned by civilians is stated to be rapidly on the increase, the total number of outbreaks reported to the Board by Local Authorities for 1918 being 4,483 as against 2,614 in 1917 and 2,147 in 1916. Reductions in the number of outbreaks are shown in both *Sheep Scab* and *Swine Fever*; the figures of the former for 1918 and 1917 being 352 and 543, and for the latter 1,407 and 2,104. The most serious occurrence of disease during the year was the reappearance of *Rabies* in the south-west of England. The existence of the disease was first established early in September, and by the end of the year 101 outbreaks had been confirmed, the counties affected being Devon, 83 cases, and Cornwall 18 cases. An account of the measures taken to prevent the spread of the disease is given in the Report.

Particulars are also given in the Report of the work of the Board in regard to the Sheep Dipping Orders and the Importation and Exportation of Animals Orders.

THE total number of outbreaks of *Rabies* confirmed is 212, namely,
 101 in Devon, 27 in Cornwall, 60 in Glamorgan,
 7 in Monmouth, 2 in Gloucester, 5 in Middlesex,
 7 in Surrey, 1 in London, and 2 in Kent.

Rabies.

THE Board of Agriculture and Fisheries are officially informed that the issue of permits for the importation into the United States of America of cattle, sheep, other ruminants, and swine from the United Kingdom has been resumed, except as regards animals which come from, or pass through the County of York.

Importation of Cattle, Sheep and Pigs into U.S.A.

* See this *Journal*, June, 1918, p. 350; November, 1918, p. 1025; January, 1919, p. 1240; and March, 1919, p. 1514.

† Annual Report of Proceedings under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, etc., for the Year 1918. London: H.M. Stationery Office, 1919, 3d. net.

**Revocation of Statutory
Rules and Orders
affecting Farmers.**

THE following Orders have recently been
revoked by the Food Controller :—

No. of Order.	Title of Order.	Page of reference in this <i>Journal</i> .
No. 1105 of 1917..	British Cheese Order, 1917 (Revoked only to the extent to which the Order relates to Caerphilly Cheese).	November, 1917, p. 910.
No. 860 of 1918 ..	Caerphilly Cheese (Requisition) Order, 1918.	August, 1918, p. 597.
No. 1036 of 1918 as amended by No. 338 of 1919.	The Calves (Sales) Order, 1918	October, 1918, p. 886, and April, 1919, p. 98.
No. 284 of 1919 ..	The Live Stock (Sales) Order, 1918: General Licence.	April, 1919, p. 98.
No. 517 as amended by No. 1413 of 1918, and Nos. 148, 420, 459, and 541 of 1919.	The Live Stock (Sales) Order, 1918 (Revoked only so far as it relates to Calves).	June, 1918, p. 350, November, 1918, p. 1025, January, 1919, p. 1240, and March, 1919, p. 1514.
No. 903, as amended by No. 943 of 1917, and No. 530 of 1919.	The Meat (Maximum Prices) Order, 1917 (Revoked only so far as it relates to veal).	September, 1917, p. 675.
No. 372 of 1918, as amended by Nos. 223 and 527 of 1919.	The Meat Retail Prices (England and Wales) Order No. 2, 1918 (Revoked only so far as it relates to veal).	May, 1918, p. 230.
No. 1638 of 1918..	The Meat (Dealers' Restriction) Order, 1918 (Revoked only so far as it relates to veal and calves' offal).	January, 1919, p. 1240.
No. 509 of 1919 ..	Seeds, Nuts, Kernels, Oils and Fats (Maximum Prices) Order, 1919.	May, 1919, p. 211.

FARMERS are urged to place their orders for binder twine without delay. The Board of Agriculture are informed by makers that the quantity ordered so far this season is much

Binder Twine.

below the average, and unless orders are placed at an early date it may be impossible to meet the demands, in view of the difficulty in securing immediate delivery by rail. Farmers should take twine into stock and not rely on obtaining supplies at the last moment.

THE Meteorological Office will, as in past years, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of a registration fee of 1s. and the

**Harvest Weather
Forecasts.**

cost of the télégrams, computed at 9d. per day. The supply of forecasts will continue until 30th September. The forecasts are drawn up each week-day at 4.30 p.m., and refer to the probable weather during the 24 hours comprising the following civil day. If the meteorological conditions are sufficiently definite, a "further outlook" extending the period covered to two or three days will be added.

Notifications will also be issued in connection with the continuance or break up of spells of fine weather. For this service a fee of 6d. is

charged for each telegram despatched, in addition to the Post Office charges for telegraphy. A minimum sum of 5s. against which the charges may be booked must be deposited with the Office.

Applications for the forecasts should be sent to the Director, Meteorological Office, South Kensington, London, S.W. 7, with a cheque or postal order payable to the Meteorological Committee, to cover the cost of the telegrams for the period during which the forecasts are to be sent.

SOME of the criticism which is being directed against the Wages Board is based on an entire misapprehension of the facts. In *Country Life*, of 3rd May, two supposed "facts" are given in support of the contention that the Orders of the Wages Board have been copied from those of the factories. The first example quoted is "the absurd regulation that, in summer, work is to stop at 5 o'clock," and it is suggested that "if the plan had been to give the men an extra hour in the morning, that is to say, letting them start an hour later, it would have been absolutely useful to them" for work in their own gardens. In return "for being allowed to come an hour later to work, or even two hours, it would have been fair and reasonable to ask them to go on two hours longer in the evening." Not only is there nothing that the Board have done which prevents this suggestion being carried out, but the Board have frequently drawn attention to the fact. The number and arrangement of working hours is a matter for mutual agreement between employer and worker, subject to payment of not less than the minimum rates and overtime rates applicable to the worker concerned under the Board's Orders.

The second complaint in this article is that "workers are not compelled to do Sunday work at all," and cases are alleged in which "labourers have absolutely refused to go to work at all on Sundays." The Wages Board have no power (as was stated in No. 4 of the *Wages Board Gazette*, 1st October, 1918) "either to prevent men from working on Sunday or to compel them to do so. Their powers in no way affect the farmers' terms of contract with his men, except with regard to the amount of wages paid for work done. The farmer can make Sunday assistance, as on a dairy farm, an essential item in his contract with the labourers." The suggestion would seem to be, now, that the Wages Board should have power to compel men to work on Sunday. It is hardly necessary to say that an Act of Parliament would be required to give them such powers.

A leader in the *Mark Lane Express* of the 12th inst. (May), contains two statements which may lead to serious misunderstanding. It is stated that the Wages Board have fixed a flat rate of 40s. per week. This, of course, is quite inaccurate. The rates, as a glance at the schedule (to the Board's Order of 16th May) will show, vary widely as regards counties, and classes and age of workers. The most usual rate for ordinary workers of 21 years and over is 36s. 6d., but it is higher in a few counties. It is also stated that the "Labour Party" brought forward a motion for an increase in all cases of 6s. 6d. It has been repeatedly stated that this figure was reached as the result of prolonged negotiation, and was only embodied eventually in an agreed motion after both sides had withdrawn their own proposals. (*Wages Board Gazette*, 15th May, 1919.)

The Ministry of Food have agreed with the Board to release a certain amount of malt for the home brewing of harvest beer. The Agricultural Executive Committees for those counties

Harvest Beer.

in which home brewing is an established custom will be authorised to issue permits to farmers for an amount not exceeding two bushels of malt for each labourer employed.

Although supplying cider or other intoxicating liquor as part payment of wages is not legal, it has been a common practice in certain districts to supply these beverages as an allowance or perquisite. Some employers in the cider districts, in view of the present legal obligation to pay the minimum wage and overtime rates, do not feel inclined to continue such supplies free, and the question has arisen as to their legal position if they sell it. Upon being consulted by the Agricultural Wages Board, the Board of Customs and Excise stated that they had no objection to the sale of cider by the farmers, provided they paid duty on all cider thus sold.

If the cider is sold in wholesale quantities (in any quantity of not less than $4\frac{1}{2}$ gal. at any one time to one person), no licence will be required by the farmer, but his premises must be registered for the purpose with the local officers of the Board of Customs and Excise. If the cider is sold in retail quantities, proper licences must be taken out.

An Agricultural Costings Committee has been set up by the Departments of Agriculture and the Ministry of Food to obtain permanent information as to the costs and results of

Agricultural Costings Committee.

farming. It is composed of representatives of the Government Departments concerned, together with members of the Central Agricultural Advisory Council and of the Consumers' Council.* The majority of the members have a practical experience of farming and represent agricultural opinion in all parts of the country.

The Committee proposes to assist farmers who already keep accounts in the difficult work of recording the costs and profits of farming operations generally, and of particular kinds of produce, as, for instance, meat, milk, cereals and potatoes. It is also hoped to induce other farmers who have not hitherto kept books to do so, and to give them assistance on similar lines, so that detailed information as to costings may be obtained on an extensive scale. The information so obtained will, it is hoped, be available for the use of the Committee's records of the costs of production, etc., and will be of great use in promoting the welfare of the industry generally and also to the farmer himself.

The farms by which costs data are provided will be denoted in the records of the Committee by a number or letter only. The information will be treated in the strictest confidence and will be available for the assistance of farmers generally, but only under the strictest anonymity.

The information which it is hoped to collect and analyse should be of practical value to the individual farmer. He will no longer be in ignorance of the actual results of the various departments of his farm; he will be able to see which of his operations are remunerative, and to concentrate on those departments which pay him best; his farming methods and system can be varied as far as is practicable and consistent with good husbandry; he can compare his own costs of a particular crop or product with the average cost in the district and investigate

* See this *Journal*, April, 1919, p. 106.

the reason for any abnormal charges in his own case. The information will also be of value in claiming relief from assessments to income tax.

Farmers who are interested in the subject should communicate with the Director, Room 247, Palace Chambers, Westminster, London, S.W. 1, who will be pleased to furnish any further information desired.

According to a Note published in the issue of the *International Review of Agricultural Economics* for April, 1919, an Act, entitled the

**Settlement of Dis-
charged Soldiers and
Sailors on the
Land in Canada.**

Soldier's Settlement Act, has been passed in Canada with the view of helping returned soldiers and sailors to settle on the land and increasing the agricultural production of Canada. The Act applies to all discharged members of the Canadian, British or Allied Forces who were British subjects and resident in Canada before the War, and also to widows of any such soldiers or sailors who died on active service.

Under the Act a settler may be granted free entry on 160 acres, subject to certain conditions. Provision is also made for making to those entitled to its benefits loans up to a maximum amount of \$2,500 (about £520), secured by a first charge or first mortgage on the land, and bearing interest at the rate of 5 per cent. per annum. The money lent may be used to acquire land for agricultural purposes, to pay off encumbrances on it, to construct farm buildings and to buy stock, machinery and equipment. The amount of the loan must in each case be justified by the value of the security offered, and it must be spent under the supervision of a Board of Commissioners.

A Board known as the Soldiers' Settlement Board, and consisting of three Commissioners, was appointed in February, 1918, for the purpose of administering the Act. There is a representative of the Board in each province, and applications for loans may be made to him by returned soldiers in respect of agricultural land in any situation.

¶ Certain Dominion lands, which were formerly a part of the Doukhobor reserves and are special valuable, have been reserved by the Ministry of the Interior and set apart for "soldier entry." As the demand for free entry on these valuable lands will be excessive, however, and it will be difficult to distribute the land equitably, and in order, also, to include soldiers who have not yet returned, the Government have passed an Order in Council authorising any specially valuable lands becoming available for soldiers' settlement to be disposed of later, and the Soldiers' Settlement Board to let such lands in the meanwhile, on lease or otherwise and on fit conditions, preferably to returned soldiers. The proceeds of such letting will be placed to the credit of a fund to be known as the "Soldier Land Settlement Fund."

SINCE the date of the List given on p. 1133 of the *Journal* for December, 1918, the following Leaflets have been issued in the *Permanent Series* :—

- No. 326.—*Injurious Weed Seeds in Grasses and Clovers Harvested for Seed in Britain.*
- „ 327.—*Rabbit Diseases.*
- „ 328.—*Smut in Oats and Barley.*
- „ 329.—*Redemption of the Tithe Rentcharge and Corn Rents : The Tithe Act, 1918.*

The following *Food Production Leaflets* have been issued :—

- F.P. No. 24.—*Compound Manures.*
 „ 60.—*Dung Heaps and the Preservation of Farmyard Manure.*
 „ 61.—*Seed Mixtures for Land affected by Clover Sickness.*
 „ 62.—*Faggot Draining—Bush Draining—Wood Ditching.*

In addition, the information in the following *Permanent Leaflets* has been revised and brought up to date :—

- No. 3.—*Flea Beetles.*
 „ 11.—*Daddy Longlegs or Crane Flies.*
 „ 14.—*The Raspberry Moth.*
 „ 20.—*The Magpie Moth.*
 „ 31.—*The Onion Fly.*
 „ 34.—*The Woolly Aphis.*
 „ 35.—*The Celery Fly.*
 „ 70.—*The Treatment of Neglected Orchards.*
 „ 72.—*The Purchase of Artificial Manures.*
 „ 75.—*Root-Knot Disease in Cucumbers and Tomatoes.*
 „ 92.—*Bunt and Smut in Wheat.*
 „ 97.—*Farmers' Co-operative Societies.*
 „ 107.—*The Mussel Scale.*
 „ 108.—*Epizootic Abortion in Cattle, or Slipping Calf.*
 „ 109.—*Cabbage Caterpillars.*
 „ 117.—*“Black-leg” of Potatoes.*
 „ 128.—*Advice to Beginners in Bee-keeping.*
 „ 142.—*Calf Rearing.*
 „ 148.—*Planning and Planting a Fruit Plantation.*
 „ 160.—*The Cultivation of Lucerne.*
 „ 179.—*The Making of Soft and Cream Cheeses and Clotted Cream.*
 „ 198.—*Rearing and Marketing of Geese.*
 „ 201.—*The Marketing of Poultry.*
 „ 223.—*The Brown Scale.*
 „ 263.—*Mustard Beetles.*
 „ 295.—*Marketing of Eggs.*
 „ 296.—*Potato Growing in Allotments and Small Gardens.*
 „ 302.—*Silver Leaf in Fruit Trees.*
 „ 307.—*The Wood Pigeon.*
 „ 310.—*Poultry on Allotments and Garden Plots.*
 „ 317.—*The Rearing of Chickens.*
 „ 321.—*Notes on Essential Points in Poultry Feeding.*
 „ 328.—*Smut in Oats and Barley.*

The following *Food Production Leaflets* have been revised and brought up to date :—

- F.P. No. 8.—*Economy in the Use of Vegetable Seeds.*
 „ 16.—*Bracken as Litter.*
 „ 20.—*The Use of Straw for Fodder.*
 „ 39.—*The Control of Pests of Fruit Trees in Gardens and Small Orchards.*
 „ 51.—*Suggestions for the Cultivation of Catch Crops and Home Grown Feeding Stuffs.*

The following Leaflet, formerly in the series of *Special Leaflets*, has been transferred to the *Food Production Series* :—

- F.P. No. 24.—*Compound Manures* (formerly *Special Leaflet No. 48*).

The following Leaflets, which had been withdrawn from circulation, have been rewritten and reissued in the *Permanent Series* :—

No. 21.—*Warble Flies*.

„ 36.—*The Cultivation of Basket Willows*.

„ 79.—*The Principles of Feeding Farm Stock*.

„ 100.—*The Breeding and Management of Pigs*.

„ 218.—*Associations for the Creation of Small Holdings*.

The following *Special Leaflet* has been withdrawn from circulation :—

No. 32.—*War Food Societies*.

The following *Food Production Leaflets* have been withdrawn from circulation :—

F.P. No. 1.—*Hints for Farmers on Growing Root Seeds for Home Use*.

„ 2.—*Credit for Farmers*.

„ 14. *The Rearing of Calves in the Summer and Autumn of 1918*.

„ 17.—*Economy in the Feeding of Horses*.

„ 25.—*Economy in the Feeding of Dairy Cows*.

„ 31.—*Smut in Barley and Oats*.

„ 36.—*War Time Allotments*.

THE Board have received resolutions from the majority of Agricultural Executive Committees drawing attention to the effect upon agriculture of present prices of petrol and paraffin, and urging that the control of these commodities should be removed. The Board

Supply of Petrol and Paraffin.

learn that Government control (under which maximum wholesale and retail prices are fixed) has now ceased, and the Petroleum Companies will in the near future be marketing supplies imported by themselves in the ordinary course of trade. It is difficult, however, at the present stage to say whether any further reduction in price will follow beyond that which has already taken place since November last. It may be explained that prices in this country have for some time been dependent upon those ruling in the United States, where the prices fixed by the United States Government during the War have been maintained, and, in the case of paraffin prices, even increased owing to the demand outrunning supply.

The Board will continue to keep themselves closely informed of the position with regard to the supply of petrol and paraffin, and will take any steps calculated to reduce the cost of these fuels to farmers whenever an opportunity occurs.

At a meeting of the Agricultural Wages Board held on 29th and 30th May it was decided after considering reports from the various

Proposal to fix Harvest Wages and to Increase Rates of Wages for Female Workers.

District Wages Committees, to proceed to issue proposals to fix special rates for the corn harvest in the following areas :—Cambridgeshire, Huntingdon, and Bedfordshire, Cheshire, Derby, Devon, Dorset, Gloucestershire, Herefordshire, Lincoln, Nottingham, Oxford, Somerset, Suffolk, Surrey, Wiltshire, Yorkshire, Anglesey, and Carnarvon, and Denbigh and Flint. No special rates for corn harvest are to be fixed in the case of the other areas in England and Wales, and an extra payment for harvest in such areas will accordingly be a matter for mutual arrangement between employers and workers, subject to payment of the workers at not less than the minimum and overtime rates applicable to them under the

Orders of the Wages Board already in force. No rates can be fixed before the expiration of a month from the date of the Notice of Proposal, during which period objections to the Proposals may be lodged with the Wages Board.

The Board having consulted the various District Wages Committees, decided to issue a Notice of Proposal to increase the minimum and overtime rates at present in operation for female workers of 18 years of age and over. No variation in the present rates, can however, be made before the expiration of a month from the date of the Notice of Proposal.

IN a reference to the Report of the Committee on Section 4 of the Advisory Council on the Employment on the Land of Returned Sailors and Soldiers, it was inadvertently stated in a **Journal, April and May, 1919: Errata.**

footnote on p. 81 of the issue of this *Journal* for April last that this Report had not been published, whereas the Report at the time had actually been issued. Copies of the Report may be obtained from H.M. Stationery Office, Imperial House, Kingsway, W.C. 2; 1s. net.

In the "Notes on Manures for June," published in the issue of this *Journal* for May last, it was stated on p. 179 that nitrate of lime contains 12 per cent. of nitrogen and nitrate of ammonia 34 per cent. of nitrogen. The figures should have been: nitrate of lime, 13 per cent., nitrate of ammonia, about 35 per cent.

MISCELLANEOUS NOTES.

THE *International Crop Report and Agricultural Statistics* for May, 1919, published by the International Institute of Agriculture, gives particulars concerning the sowing of winter cereals in the Northern Hemisphere. The areas estimated to have been sown with

Notes on Crop Prospects and Live Stock Abroad.

wheat in 1918-19, compared with the areas sown during the corresponding period of 1917-18, expressed as percentages, are as follows:—Denmark 80, Spain 111, France 98, England and Wales 96, Scotland 88, Italy 97, Canada 95, United States 133, British India 66, Japan 93; with rye.—Denmark 103, Spain 137, France 93, England and Wales 95, Italy 100, United States 102; with barley.—Spain 136, France 103, Italy 95, Japan 108; with oats.—France 97, Italy 92.

The condition of the crops on the 1st May is as follows (100 being taken to represent the average yield during the last 10 years):—Wheat.—Ireland 100, Greece 85, United States 118; rye.—Greece 86, United States 106; barley.—Greece 87; oats.—Ireland 100, Greece 88.

The yield of wheat in British India in 1918-19 is estimated at 34,743,000 qr., against 47,451,000 qr. in 1917-18, or a decrease of 26.8 per cent.

On the basis of the condition of winter wheat on the 1st May, 1919, the crop in the United States is estimated at 112,459,000 qr. in 1918-19, as compared with 69,788,000 qr. in 1917-18, or an increase of 61.1 per cent., while the forecast of the coming rye crop, made on the same basis, places the production at 14,340,000 qr. in 1918-19, or an increase of 38 per cent. compared with 1917-18, when the yield amounted to 10,392,000 qr.

Italy.—This year's acreage under maize is estimated to be nearly 4 per cent. greater than last year's but 8 per cent. below the average. (*Broomhall's Corn Trade News*, 29th May, 1919.)

United States.—The Crop Reporting Board of the United States Department of Agriculture give the following estimates of production based on the condition of the crops on 1st June (in bush. and final official returns for 1918 in brackets):—Winter wheat, 893,000,000 (558,449,000); spring wheat, 343,000,000 (358,651,000); oats, 1,446,000,000 (1,538,359,000); barley, 232,000,000 (256,375,000); and rye, 107,000,000 (89,103,000).

The average yield per acre compared with that of 1918 (in brackets) is as follows (in bush.):—Winter wheat, 18.2 (15.2); spring wheat, 15.2 (16.0); oats, 34.1 (34.6); barley, 26.0 (26.5); and rye, 16.3 (14.4).

The area under spring wheat shows an increase of 0.08 per cent. as compared with the acreage harvested last year, under oats a decrease 4.6 per cent., and under barley a decrease of 8.1 per cent. (*London Grain, Seed and Oil Reporter*, 10th June, 1919.)

South Africa.—The acreage under maize this season is estimated to be 11 per cent. smaller than that of last year. For the Union, as a whole, the crop condition is placed at 22 per cent. below normal; favourable rains in March came too late to revive the crop which suffered from drought in the early part of the season and damage has been done by insect pests. (*London Grain, Seed and Oil Reporter*, 29th May, 1919.)

Canada.—The High Commissioner for Canada was informed on the 3rd June, by cablegram from the Minister of Immigration and Colonisation at Ottawa that crop conditions throughout the Dominion were reported to be very satisfactory. Fine warm weather is prevailing generally.

South Australia.—The Government statistician estimates the wheat yield for the past season at 23,000,000 bush., the average yield being 10.5 bush. per acre, against 28,000,000 bush. with an average of 12 bush. per acre in the previous year. The barley crop is estimated at 2,500,000 bush. which is an increase of 30 per cent. on the previous record crop. The yield of oats has only been exceeded three times previously. (*London Grain, Seed and Oil Reporter*, 10th June, 1919.)

India.—The final official forecasts of the yield of linseed and rapeseed in the Bombay Presidency, including Sind, are linseed, 5,000 tons and rapeseed 11,000 tons, against 21,000 and 58,000 tons respectively, the final figures of last year. (*London Grain, Seed and Oil Reporter*, 2nd June, 1919.)

Live Stock in Denmark.—The number of pigs according to the census of the 10th February, 1919, is 583,366, against 726,844 on the 10th December, 1918, 513,012 on the 5th February, 1918, and 2,496,706 on the 15th July, 1914. (*International Crop Report and Agricultural Statistics*, May, 1919.)

Live Stock in Italy.—Provisional figures resulting from the general census of live stock on the 7th April, 1918, give the following numbers, exclusive of animals in army service:—Horses 804,168, asses 944,611, mules 308,875, cattle 6,162,259, pigs 2,337,304, sheep 11,751,575, goats 3,082,554. (*International Crop Report and Agricultural Statistics*, May, 1919.)

Live Stock in Sweden.—The numbers of live stock on the 1st June, 1918, are as follows (the numbers on the 1st June, 1917, being shown in brackets):—Horses 714,822 (715,101); cattle 2,584,159 (3,020,381); sheep 1,409,473 (1,344,202); pigs 633,862 (1,029,967). (*International Crop Report and Agricultural Statistics*, May, 1919.)

THE Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on the 1st June, state that the dry weather was generally favourable for farming operations and enabled arrears of work to be greatly reduced. Rain, however, is now badly needed for the corn crops, fruit, and grass.

**Agricultural
Conditions in England
and Wales
on 1st June.**

Wheat generally looks well, particularly the autumn sown, but spring sown and that on ploughed grass land is not so satisfactory, considerable damage having been done by wireworm. Oats have also suffered from the same cause, and resowing has in some districts been necessary. The late-sown oats have also been adversely affected by the drought. Barley, though backward, generally looks well, especially the early sown, and all corn crops would be much benefited by rain. Beans and peas are promising though the former are short in the haulm. The area under barley is rather greater than last year, but that under oats slightly less.

Potatoes are backward, and there is still some planting to be done, and much of the main crop is not yet showing above the ground. The early varieties look healthy and promising but need rain. The area under potatoes is estimated to be about 15 per cent. less than last year.

The sowing of mangolds was backward but is now nearly completed. The earlier sown germinated well but now require rain, and fly is reported to be troublesome. Turnip sowing is now in progress but is very backward, and in many districts rain is needed for the preparation of the seed bed.

The weather has been very favourable for hops in Kent and the plants are healthy and have made excellent growth. The aphid has made its appearance in many instances. The area has increased by about 5 per cent. since last year.

The prospects for all classes of fruit are good, though insect pests are now proving troublesome, and rain would be welcome. Both orchard fruit and small fruit promise to exceed the average.

The area intended for hay, whether from seeds or meadow, is slightly less than last year, about 2 per cent. It would have much benefited with rain, and the yield is expected to be for both kinds about 10 per cent. below the average.

Pastures are now becoming bare and require rain. Live stock are generally healthy and have done well during the month.

The supply of labour is still short, especially of skilled hands, but in some districts the supply of casual labour has been sufficient to meet the demands.

The following local summaries give further details regarding agricultural labour in the different districts of England and Wales :—

**Agricultural
Labour in
England and Wales
during May.**

Northumberland, Durham, Cumberland, and Westmorland.—In a few districts the supply is about sufficient, but as a rule there is a shortage of all kinds, especially of skilled men.
Lancashire and Cheshire.—The supply of labourers, particularly of the skilled classes, is still deficient.

Yorkshire.—Skilled labour is deficient throughout the division. The supply of casual labour is generally short, though in some places there is about enough for the local requirements.

Shropshire and Stafford.—The supply of labour is generally still deficient. Wages generally have been further increased.

Derby, Nottingham, Leicester, and Rutland.—There is a general shortage of skilled hands, especially horsemen and cattlemen, but in most districts the supply of casual labour appears to be about sufficient.

Lincoln and Norfolk.—The supply of labour, though adequate in several districts in Norfolk, is generally deficient, horsemen and cattlemen being particularly scarce.

Suffolk, Cambridge and Huntingdon.—Labour is still deficient although the situation appears to be improving slowly.

Bedford, Northampton, and Warwick.—Cattlemen and horsemen are scarce and the supply of labour generally is still deficient, though it has been sufficient for requirements in one or two districts.

Buckingham, Oxford, and Berkshire.—In most districts the supply of labour is sufficient, but in a few places there is a deficiency of skilled hands. Wages have been increased during the last fortnight.

Worcester, Hereford, and Gloucester.—The supply of labour has improved though it is still insufficient, particularly as regards skilled men and casual workers.

Cornwall, Devon, and Somerset.—The supply of labour remains short, especially in the case of skilled men.

Dorset, Wiltshire, and Hampshire.—Labour is still short in most districts, but farmers are reducing their requirements as much as possible.

Surrey, Kent, and Sussex.—Labour is deficient, the withdrawal of soldiers being seriously felt by some farmers.

Essex, Hertford, and Middlesex.—The supply of labour, particularly of skilled men, is generally deficient, though occasionally unskilled labour has proved sufficient for requirements.

North Wales.—There is some improvement over last month, but still local shortages of unskilled labour and a fairly general shortage of skilled men of all classes, especially of horsemen and cattlemen.

Mid Wales.—The supply of labour varies. In some parts of the division there is sufficient to meet the requirements, but in others there is a great shortage, especially of skilled men.

South Wales.—Labour is deficient in all branches and the larger farmers especially are having great difficulty in obtaining men.

AVERAGE PRICES of British Wheat, Barley, and Oats at certain Markets during the Month of May, 1917, 1918, and 1919.

	WHEAT.						BARLEY.						OATS.					
	1917.		1918.		1919.		1917.		1918.		1919.		1917.		1918.		1919.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
London ...	79	3	74	0	73	0	65	10	57	1	65	11	56	0	47	9	53	0
Norwich ...	77	6	73	6	73	4	64	10	55	5	63	1	54	9	44	0	49	9
Peterborough	77	10	73	11	73	1	64	1	50	9	62	2	54	6	43	11	48	1
Lincoln ...	77	6	73	4	73	5	62	0	56	6	63	4	55	1	—		47	6
Doncaster ..	77	11	73	1	72	9	65	1	56	6	62	9	54	11	—		47	7
Salisbury ...	77	10	73	2	72	10	65	5	56	1	62	0	54	10	47	7	47	9

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1917, 1918 and 1919.

Weeks ended (the 1919).	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919.	1917.	1918.	1919.
Jan. 4...	s. d. 76 0	s. d. 71 2	s. d. 72 2	s. d. 66 4	s. d. 58 0	s. d. 62 3	s. d. 47 1	s. d. 45 5	s. d. 48 8
" 11...	75 8	71 2	72 6	65 7	58 2	62 5	47 2	46 9	49 8
" 18...	75 8	71 3	72 7	64 9	58 1	62 3	47 4	47 9	50 0
" 25...	75 10	71 1	72 7	64 5	58 7	61 10	47 8	48 2	49 6
Feb. 1...	75 10	71 2	72 8	64 0	58 10	62 4	47 3	50 2	49 7
" 8...	76 0	72 0	72 7	63 5	59 0	62 3	46 11	50 6	49 2
" 15...	76 3	72 3	72 8	63 8	58 11	62 5	47 3	52 0	49 0
" 22...	76 9	72 2	72 8	63 9	58 9	62 6	47 8	52 3	49 4
Mar. 1...	77 4	72 2	72 7	64 0	57 9	62 7	48 0	52 0	48 8
" 8...	78 0	72 3	72 6	63 7	58 5	62 7	48 7	52 2	48 6
" 15...	78 10	72 4	72 5	64 1	56 10	62 5	49 4	51 0	46 8
" 22...	80 3	72 3	72 7	65 6	56 9	62 1	50 4	50 3	46 4
" 29...	81 5	72 4	72 7	71 10	56 7	62 8	51 10	48 10	46 11
Apl. 5...	84 4	72 11	72 6	69 11	56 7	62 8	55 1	49 10	47 2
" 12...	85 2	73 3	73 0	71 10	56 6	62 9	57 2	47 2	47 1
" 19...	84 10	73 3	73 1	70 6	56 6	62 9	59 8	47 0	47 3
" 26...	81 1	73 3	73 1	69 5	56 10	62 9	58 6	46 8	48 1
May 3...	77 7	73 5	73 2	64 4	56 5	62 8	54 9	47 4	48 7
" 10...	78 0	73 5	73 2	64 11	56 6	63 1	55 2	47 6	47 5
" 17...	77 11	73 4	73 3	64 10	56 6	62 4	55 2	46 4	47 11
" 24...	78 0	73 3	73 2	64 9	56 6	62 7	54 11	47 8	47 11
" 31...	78 0	73 8	73 3	65 11	60 0	62 7	54 11	44 9	48 3
June 7...	78 0	73 11	73 2	67 7	59 2	62 6	55 0	45 5	47 10
" 14...	78 2	74 3		75 6	57 9		55 1	45 7	
" 21...	78 1	74 4		75 0	58 5		55 2	47 8	
" 28...	78 3	74 4		73 11	57 10		55 1	46 4	
July 5...	78 1	74 4		69 5	61 7		55 2	46 10	
" 12...	78 2	74 4		70 10	57 5		55 1	47 0	
" 19...	78 3	74 3		72 1	60 5		55 2	45 4	
" 26...	78 3	74 3		65 7	56 11		55 2	46 2	
Aug. 2...	78 2	74 3		73 6	57 1		55 0	45 10	
" 9...	78 4	74 7		76 1	57 7		55 0	46 3	
" 16...	78 7	74 2		68 11	61 4		55 6	55 11	
" 23...	76 7	74 8		70 7	62 6		54 7	56 9	
" 30...	72 1	74 8		60 4	60 1		49 0	57 11	
Sept. 6...	71 6	72 3		59 3	60 4		46 7	56 9	
" 13...	70 7	72 5		57 2	60 1		45 0	49 2	
" 20...	70 8	72 6		56 10	60 4		45 8	49 11	
" 27...	70 6	72 7		58 5	60 3		44 7	50 3	
Oct. 4...	70 8	72 8		57 9	60 3		44 9	50 9	
" 11...	71 0	72 6		58 5	60 3		44 5	51 6	
" 18...	70 8	72 7		59 3	60 3		44 1	50 9	
" 25...	70 10	72 5		60 1	60 3		43 0	50 5	
Nov. 1...	70 4	72 4		59 11	60 3		42 4	50 8	
" 8...	70 3	72 4		60 2	60 3		42 11	49 11	
" 15...	70 3	72 5		60 2	60 3		43 0	49 10	
" 22...	70 2	72 4		59 9	60 10		43 1	51 1	
" 29...	70 2	72 3		59 3	62 2		44 6	50 4	
Dec. 6...	70 7	72 4		58 7	62 6		43 5	51 4	
" 13...	71 2	72 3		58 0	62 7		43 6	51 4	
" 20...	71 1	72 4		57 7	62 3		44 2	50 5	
" 27...	71 1	72 3		57 7	62 3		44 10	50 6	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in May and April, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	MAY.		APRIL.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.
FAT STOCK :—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Cattle :—				
Polled Scots	85 9	80 5	83 3	78 0
Herefords	85 8	79 11	83 6	77 8
Shorthorns	85 1	79 10	82 11	77 8
Devons	85 2	80 0	83 2	77 9
Welsh Runts	85 3	78 0	83 6	78 0
Fat Cows	79 11	71 10	77 10	69 8
	First Quality. per lb.*	Second Quality. per lb.*	First Quality. per lb.*	Second Quality. per lb.*
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
Veal Calves	10½	9½	11	9½
Sheep :—				
Downs	14½	14½	14½	14½
Longwools	14½	14½	14½	14½
Cheviots	14½	14½	14½	14½
Blackfaced	14½	14½	14½	14½
Welsh	14½	14½	14½	14½
Cross-breds	14½	14½	14½	14½
	per score. live weight.	per score. live weight.	per score. live weight.	per score. live weight.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Pigs :—				
Bacon Pigs	21 0	21 0	21 0	21 0
Porkers	21 0	21 0	21 0	21 0
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>
Shorthorns—In Milk ...	50 4	37 10	49 0	36 10
—Calvers	45 4	35 6	44 9	33 15
Other Breeds—In Milk ...	40 6	32 0	44 0	29 16
—Calvers	—	—	—	—
Calves for Rearing	3 13	2 13	3 9	2 10
Store Cattle :—				
Shorthorns—Yearlings ...	17 11	14 7	16 19	13 17
—Two-year-olds ...	28 6	23 2	27 11	22 14
—Three-year-olds ...	39 1	33 1	36 14	31 2
Herefords—Two-year-olds ...	31 2	25 0	30 3	27 4
Devons—	30 9	25 12	27 7	22 16
Welsh Runts—	28 7	22 10	27 16	22 13
Store Sheep :—				
Hoggs, Hoggets, Togs, and Lambs—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Downs or Longwools ...	87 1	70 3	82 9	64 5
Store Pigs :—				
8 to 12 weeks old	65 2	48 2	56 4	41 6
12 to 16 " "	98 5	79 7	93 4	72 0

* Estimated carcass weight.

NOTE.—The prices per lb. for sheep do not include the value of the skins or pelts, which during May made prices equivalent to an additional 1½d. per lb. of the carcass weight for Downs, Cheviots and Cross-breds, and 2d. for Longwools, Blackfaced, and Welsh, and during April, 2d. per lb. for Downs, Longwools, Blackfaced and Crossbreds, and 1½d. for Cheviots and Welsh.

In addition to the price quoted above for sheep per lb., sellers were entitled, under the Live Stock (Sales) Order, 1918, to charge an extra amount ranging from 2s. to 16s. 8d. per head during May, and 4s. to 13s. 4d. during April, according to the weight of the sheep.

AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in May, 1919.

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	London.	Man- chester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
		s. d.	s. d.	s. d.	s. d.	s. d.
BEEF:—						
English	1st	118 6	118 6	—	118 6	118 6
	2nd	118 6	118 6	—	118 6	118 6
Cow and Bull	1st	118 6	118 6	118 6	118 6	118 6
	2nd	118 6	118 6	100 0	104 6	100 0
Irish: Port Killed	1st	119 0	—	118 6	118 6	118 6
	2nd	119 0	—	118 6	118 6	118 6
Argentine Frozen—						
Hind Quarters	1st	117 6	117 6	117 6	117 6	117 6
Fore "	1st	87 0	87 0	87 0	87 0	87 0
American Frozen—						
Hind Quarters	1st	115 0	115 0	115 0	115 0	115 0
Fore "	1st	85 0	85 0	85 0	85 0	85 0
Canadian Frozen—						
Hind Quarters	1st	115 0	115 0	115 0	115 0	115 0
Fore "	1st	85 0	85 0	85 0	85 0	85 0
VEAL:—						
British	1st	98 0	98 0	98 0	98 0	98 0
	2nd	98 0	84 0	84 0	84 0	84 0
Foreign	1st	—	—	—	—	—
MUTTON:—						
Scotch	1st	125 6	125 6	125 6	125 6	125 6
	2nd	125 6	125 6	125 6	125 6	125 6
English	1st	125 6	125 6	—	125 6	125 6
	2nd	125 6	125 6	—	125 6	125 6
Irish: Port Killed	1st	—	—	125 6	—	125 6
	2nd	—	—	125 6	—	125 6
Argentine Frozen	1st	109 6	109 6	109 6	109 6	109 6
New Zealand "	1st	—	107 6	—	—	—
Australian "	1st	—	—	—	107 6	—
LAMB:—						
British	1st	—	—	—	—	—
	2nd	—	—	—	—	—
New Zealand	1st	109 6	109 6	109 6	109 6	109 6
Australian...	1st	—	—	—	—	—
Argentine...	1st	109 6	109 6	109 6	109 6	109 6
PORK:—						
British	1st	—	149 6	149 6	149 6	149 6
	2nd	—	—	—	—	—
Frozen	1st	—	—	—	—	—

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at
certain MARKETS in ENGLAND in May, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	—	—	—	—	27 6	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	—	—	—	—	—	—
„ Factory	—	—	—	—	—	—
Imported (Controlled)	252 0	—	252 0	—	252 0	—
CHEESE :—						
British—						
Cheddar	144 6	—	—	—	144 6	—
			120 lb.		120 lb.	
Cheshire	—	—	155 0	—	155 0	—
			per cwt.		per cwt.	
Canadian	144 6	—	144 6	—	144 6	—
BACON :—						
Irish (Green)	195 6	—	195 6	—	195 6	—
Canadian (Green sides)	190 0	—	190 0	188 0	192 0	188 0
HAMS :—						
York (Dried or						
Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green)						
(long cut)	183 6	—	184 0	182 6	184 0	182 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	32 6	30 0
Irish	30 3	—	30 4	28 9	30 1	28 1
Danish	—	—	—	—	32 8	30 4
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Arran Chief	200 0	190 0	—	215 0	200 0	—
Edward VII.	230 0	220 0	215 0	175 0	215 0	—
Up-to-Date	230 0	200 0	185 0	170 0	—	—
HAY :—						
Clover	—	—	—	—	—	—
Meadow	—	—	—	—	—	—

DISEASES OF ANIMALS ACTS 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	MAY.		FIVE MONTHS ENDED MAY.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	24	19	88	132
Animals attacked	32	20	119	148
Foot-and-Mouth Disease :—				
Outbreaks	—	—	19	—
Animals attacked	—	—	154	—
Glanders (including Farcy) :—				
Outbreaks	7	2	12	15
Animals attacked	10	6	38	42
Parasitic Mange :—				
Outbreaks	479	432	3,082	2,661
Animals attacked	911	815	6,069	5,118
Rabies :—				
Number of cases	44	—	101	—
„ „ Dogs affected	43	—	98	—
„ „ other animals affected	1	—	3	—
Sheep-scab :—				
Outbreaks	5	13	212	235
Swine Fever :—				
Outbreaks	207	210	719	533
Swine slaughtered as diseased or exposed to infection	138	63	287	177

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	MAY.		FIVE MONTHS ENDED MAY.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	1
Glanders (including Farcy) :—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Parasitic Mange :—				
Outbreaks	18	11	74	68
Sheep-scab :—				
Outbreaks	11	13	150	164
Swine Fever :—				
Outbreaks	2	—	18	7
Swine slaughtered as diseased or exposed to infection	2	—	59	27

The Weather in England during May.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
<i>Week ending 3rd May :</i>								
England, N.E. ...	42.2	-4.5	0.88	22	+11	6	4.7	-1.2
England, E. ...	43.3	-5.0	1.07	27	+17	6	4.7	-1.7
Midland Counties ...	43.3	-4.6	0.88	22	+10	6	3.5	-2.1
England, S.E. ...	43.8	-5.5	1.05	27	+17	6	3.6	-3.0
England, N.W. ...	43.1	-4.5	0.91	23	+7	6	4.6	-1.1
England, S.W. ...	44.2	-4.5	0.87	22	+6	7	3.0	-2.9
English Channel ...	46.7	-3.9	0.60	15	+2	6	2.7	-4.5
<i>Week ending 10th May :</i>								
England, N.E. ...	48.5	+0.1	0.25	6	-5	3	3.2	-2.8
England, E. ...	52.1	+2.3	0.14	4	-6	1	6.1	-0.3
Midland Counties ...	52.3	+2.7	0.42	11	+1	2	3.3	-2.5
England, S.E. ...	53.2	+2.1	0.16	4	-5	2	6.1	+0.1
England, N.W. ...	51.4	+2.1	0.36	9	-3	4	4.7	-1.3
England, S.W. ...	51.9	+1.4	0.18	5	-7	2	5.5	-1.2
English Channel ...	53.7	+1.8	0.43	11	-2	3	5.5	-0.5
<i>Week ending 17th May :</i>								
England, N.E. ...	55.9	+6.6	0.17	4	-7	2	8.8	+2.6
England, E. ...	57.7	+6.4	0.07	2	-9	1	9.6	+3.0
Midland Counties ...	58.2	+7.0	0.09	2	-11	1	7.9	+1.9
England, S.E. ...	57.5	+5.4	0.07	2	-9	1	8.8	+1.7
England, N.W. ...	58.2	+7.5	0.13	4	-9	1	7.0	+0.4
England, S.W. ...	55.0	+3.0	0.34	9	-3	3	6.2	-0.6
English Channel ...	56.4	+3.2	0.57	14	+4	2	7.4	-0.4
<i>Week ending 24th May :</i>								
England, N.E. ...	53.4	+2.7	0.09	2	-10	1	9.5	+3.3
England, E. ...	55.0	+2.1	0.04	1	-10	1	10.7	+3.9
Midland Counties ...	55.7	+3.2	0.06	2	-11	1	9.1	+3.3
England, S.E. ...	55.9	+2.1	0.00	0	-11	0	10.6	+3.6
England, N.W. ...	55.2	+3.2	0.31	8	-3	1	7.4	+1.1
England, S.W. ...	54.6	+1.6	0.15	4	-9	1	5.2	-1.4
English Channel ...	55.0	+0.5	0.44	11	-2	1	6.0	-1.8
<i>Week ending 31st May :</i>								
England, N.E. ...	55.5	+2.5	0.03	1	-10	1	9.3	+3.0
England, E. ...	54.3	-0.7	0.20	5	-5	1	10.8	+3.6
Midland Counties ...	57.7	+3.0	0.06	2	-10	1	9.5	+3.2
England, S.E. ...	56.4	+0.7	0.03	1	-9	1	10.2	+2.8
England, N.W. ...	58.4	+4.5	0.07	2	-12	1	10.5	+3.8
England, S.W. ...	57.2	+2.3	0.00	0	-17	0	10.3	+3.7
English Channel ...	57.2	+1.2	0.11	3	-9	1	9.4	+1.3

* 1 inch = 25.4 millimetres.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

- Christoph, F.*—Landwirtschaft und Industrie. (160 pp.) Hannover : M. & H. Schaper, 1918. [338.1; 63(28).]
- Strutt, E. G.*; *Scott, Leslie*; *Roberts, G. H.*—The Policy of the Plough. (46 pp.) [Rural Problem Series.] London : S.P.C.K., 1919. 6d. net. [63.196; 338.99.]
- Gain, Edmond.*—Précis de Chimie Agricole. (510 pp.) Paris : Librairie J. B. Ballière et Fils, 1918. [54(02).]
- Wery, Georges.*—Les Etablissements Scientifiques de Recherches Agricoles en France et à l'Étranger. (164 pp.) Paris : Société d'Encouragement pour l'Industrie Nationale, 1918. [37(44); 37(072).]
- Conn, H. W.*—Agricultural Bacteriology. A Study of the Relation of Germ Life to the Farm. [3rd Edition.] (357 pp.) Philadelphia : P. Blakiston's Son & Co., 1918. [576.8.]
- Plowman, T. F.*—Fifty Years of a Showman's Life. (333 pp.) London : John Lane, 1919. 12s. 6d. net. [63(064); 92.]
- Ministry of Reconstruction.*—Pamphlet No. 13 : Rural Industries. (16 pp.) London : H.M. Stationery Office, 1919. 2d. [63.193.]
- Allen, T.*—Small Farming that Pays. [Second Edition.] (88 pp.) London : Cable Printing Company, 1919. 1s. 6d. net. [63.191.]
- Lyon, T. L.*—Soils and Fertilizers. (255 pp.) New York and London : The Macmillan Company, 1918. [63.11(02); 63.16(02).]
- Woodhead, S. A.*—Elementary Chemistry of Agriculture. (188 pp.) London : Macmillan & Co., 1919. [54(02).]
- Van Eecke, Ch.*—Exploitation Industrielle de La Tourbe (with Bibliography.) (370 pp.) Paris : H. Dunod et E. Pinat, 1918. 12fr. 50 (+ 20%). [662.6.]
- Lloyd, E. W.*—Hints to Farm Pupils. (112 pp.) London : John Murray, 1919. 2s. 6d. net. [63(022).]

Field Crops—

- Palmer, S. G.*—Sugar Beet Seed : History and Development. (120 pp.) New York : Wiley & Sons. [London : Chapman & Hall], 1918. 6s. 6d. [63.3432.]
- Teetgen, A. B.*—Profitable Herb Growing and Collecting. [2nd Edition.] (195 pp.) London : "Country Life" Offices, 1919. 5s. net. [63.348.]
- Worcestershire County Council, Education Committee.*—Report on the Varieties of Mangel Trials carried out during 1915, 1916, 1917, and 1918. (10 pp.) Worcester, 1919. [63.332.]
- Carter, H. R.*—Flax : Its Cultivation and Preparation for Market. (84 pp.) London : John Bale, Sons, and Danielsson, 1918. 3s. 6d. net. [63.34111.]
- Royal Society, Food (War) Committee.*—Report on the Composition of Potatoes grown in the United Kingdom. (31 pp.) London : Harrison & Sons, 1919. 2s. [63.512(04).]
- Ellmore, W. P.*—The Cultivation of Osiers and Willows. (96 pp. + 14 pl.) London : J. M. Dent & Sons, 1919. 4s. [63.3412.]

Horticulture—

- Dyke, W.*—The Science and Practice of Manuring for the Use of Amateur, Market and Professional Growers, Orchardists, etc. (Revised edition.) (156 pp.) London : Lockwood Press, 1919. 2s. net. [63.51(02).]
- Macself, A. J.*—Seed Farming in Britain : A Practical Treatise on the Cultivation of Vegetables for the Production of Seeds. (32 pp.) Burnley : Hortus Printing Company, 1919. 2s. 6d. [63.1951; 63.51(02).]
- Woburn Experimental Fruit Farm.*—16th Report [Manurial Experiments on Fruit Trees, Bushes and Other Crops.] (76 pp.) London : Amalgamated Press, 1917. 2s. 9d. [63.41(04).]
- Elms, E. T.*—Jottings of an Allotment Gardener. (144 pp.) Mexborough : "Times" Printing Company, 1919. 1s. 6d. net. [63.5(08).]

Plant Diseases—

- Eriksson, J.*—Zur Entwickelungsgeschichte des Spinatschimmels (*Peronospora Spinaciae*). (25 pp. + 4 pl.) Stockholm, 1918. [63.24.]
- Nova Scotia, Department of Agriculture.*—Bull. 9 :—The Apple Maggot (*Rhagoletis pomonella*) in Nova Scotia. (70 pp. + 6 pl.), 1917. Truro, Nova Scotia, 1917. [63.27; 63.27-41.]

Crosby, C. R. and Leonard, M. D.—Manual of Vegetable-Garden Insects. (391 pp.) New York and London: The Macmillan Company, 1918. \$2.50. [63.27(02); 63.27-51.]

Mosley, F. O.—Fungoid and Insect Pests and their Control: Part I.:—Vegetable and Pulse Crops. (24 pp.) The Author, Whernside, Basingstoke Road, Reading, 1918. 1s. net. [63.24(02); 63.27(02).]

Mosley, F. O.—Fungoid and Insect Pests and their Control: Part II.:—Fruit Trees. (31 pp.) The Author, Whernside, Basingstoke Road, Reading, 1918. 2s. 6d. net. [63.24(02); 63.27(02).]

Banks, N.—Index to the Literature of American Economic Entomology. January, 1905—December, 1914. (323 pp.) Melrose Highlands, Mass. American Association of Economic Entomologists, 1917. \$5.50. [01; 63.27(02).]

Whetzel, H. H.—An Outline of the History of Phytopathology. (130 pp.) Philadelphia and London: W. B. Saunders Company, 1918. [63.2(02).]

Live Stock—

Ormerod, F.—Wool [Staple Trades and Industries, Vol. I.] (218 pp.) London: Constable & Co., 1918. 6s. 6d. net. [63.761; 677.]

West of Scotland Agricultural College.—Bull. 89:—Reports on Experiments on the Feeding Value of Bracken Rhizomes for Pigs and Poultry. (103-107 pp.) Glasgow, 1919. [63.604(a).]

Pearce, A. W.—The World's Meat Future. An Account of the Live Stock Position and Meat Prospects of all Leading Stock Countries of the World with Full Lists of Freezing Works. (272 pp.) Sydney: John Andrew & Co., 1918. 10s. 6d. [63.6: 31; 664.8.]

Mansell, A.—The Future of our Live Stock Industry. (Journal of the Farmers' Club, March, 1919.) (38 pp.) 6d. [63.6(42).]

Dairying and Food, General—

Dymond, T. S.—Dairy Farming in Denmark. (24 pp.) [Rural Problems Series.] London: S.P.C.K., 1919. 4d. net. [63.7(489).]

International Institute of Agriculture.—Documentary Leaflets, 3rd Year, No. 2:—Production and Prices of Milk and its Chief Derivatives) (51 pp.) Rome, 1919. [63.7; 63.714.]

Eckles, C. H., and Warren, G. F.—Dairy Farming. (309 pp.) New York: The Macmillan Company, 1916. [63.70(02).]

Wallace, R.—The Tragedy of Milk Production. (40 pp.) Edinburgh: Oliver and Boyd, 1919. 6d. [614.32.]

Royal Society, Food (War) Committee.—Report on the Food Requirements of Man and their Variations according to Age, Sex, Size and Occupation. (19 pp.) London: Harrison & Sons, 1919. 1s. 6d. [612.39.]

Birds, Poultry, and Bees—

Wilson, Rev. John.—Indian Runner Duck Breeding. (19 pp.) Armthwaite, Carlisle; The Author, 1918. 1s. 6d. post free. [63.657.]

Watson, J. A.—Money from Ducks. (29 pp.) London: Poultry Press, Ltd., 1919. 9d. net. [63.657.]

Matthews, Ihe.—Full Revelations of a Professional Rat-catcher. (63 pp.) Manchester: Friendly Societies' Printing Company, 1898. 1s. [63.269.]

Remington, J. S., and Remington, M. E.—Utility Poultry Farming. (82 pp.) Grange-over-Sands: H. T. Mason, 1919. 2s. post free. [63.651(02).]

Forestry—

Ministry of Reconstruction.—Reconstruction Pamphlet 11:—Commercial Forestry. (14 pp.) London: H.M. Stationery Office, 1919. 2d. net. [63.49(04).]

Webster, A. D.—Firewoods: Their Production and Fuel Values. (95 pp.) London: T. Fisher Unwin, 1919. 12s. 6d. net. [674; 63.49-197.]

Economics—

Middleton, Sir T. H.—The Farmer's Task. (20 pp.) [Rural Problem Series.] London: S.P.C.K., 1919. 3d. net. [63(42); 338.99.]

Nicholls, G.—The Place of the Smallholder in the Problem of Reconstruction. (14 pp.) London: S.P.C.K., 1919. 3d. net. [338.99; 333.38(42).]

Smith-Gordon, L.—Co-operation for Farmers. (247 pp.) London: Williams & Norgate, 1918. 6s. net. [334(02).]

- Rew, Sir R. H.*—The Minimum Wage as applied in Agriculture. (20 pp.) (Journal of the Farmers' Club, February, 1919.) London. 6d. [331(b).]
- Lange, F.*—Landwirtschaftlich Statistischer Atlas. Die Landwirtschaftliche Erzeugung der Welt—Der Deutsche Aussenhandel. (105 karten nebst Einleitung). Berlin: Dietrich Reimer (Einst Vohsen), 1917. 72 marks. [31; 31(43).]
- Ministry of Reconstruction.*—Pamphlet 14:—Food Production and Its Problems for the Consumer. (24 pp.) London: H.M. Stationery Office, 1919. 2d. [338.99; 63(42).]
- Ministry of Reconstruction.*—Report on the Employment on the Land of Returned Sailors and Soldiers; together with a Report by *R. V. Lennard*. (39 pp.) London: H.M. Stationery Office, 1919. 1s. net. [325.]
- Hughes, W. R. [Edit.].*—New Town. A Proposal in Agricultural, Industrial, Educational, Civic, and Social Reconstruction (141 pp.) London: J. M. Dent & Sons, 1919. 2s. net. [33.]

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

- Field Technic in Determining Yields of Experimental Plots by the Square Yard Method, *A. C. Arny* and *F. H. Steinmetz*. (Jour. American Soc. Agronomy, March, 1919.) [37(01).]
- A Field Study of the Influence of Organic Matter upon the Water-Holding Capacity of a Silt-Loam Soil, *F. J. Alway* and *J. R. Neller*. (Jour. Agric. Research, 10th March, 1919.) [63.112.]
- L'Agriculture française et la guerre, *Henry Sagnier*. (Travaux et Notices de l'Académie d'Agric., France, Tome I, 1918.) [63(44).]
- La situation de l'agriculture en pays envahi (Nord de la France et Belgique) Août, 1914—Mars 1917, *H. Lecq*. (Travaux et Notices de l'Académie d'Agric., France, Tome I, 1918.) [63(44).]
- Elektrokali, ein schwedisches Kalidüngemittel und seine Wirkung auf Mineralboden, *P. Ehrenburg* et al. (Jour. Landwirtschaft, 66 Band, Heft IV., 1918.) [63.1673.]
- The Present Status of Nitrogen Fixation, *A. H. White*. (Jour. Ind. Engin. Chem., 1st March, 1919.) [576.83.]
- Danish Agriculture and the World War, *J. J. Dunne*. (Better Business, February, 1919.) [63(489).]
- Present Position in Relation to Fertilisers and Feeding Stuffs, *A. Smetham*. (Jour. Roy. Lanc. Agric. Soc., 1918.) [63.1621; 63.604(a).]
- The Action of Lime in the Soil, *J. Hughes*. (Jour. Bath & West & S. C. Soc., 1918-19.) [63.15.]
- Ensilage, *A. W. Oldershaw*. (Jour. Bath & West & S.C. 1918-19.) [63.1985.]
- Various Researches into Structure of Soils and Soil Moisture, *J. Dumont*. (Ann. Ecole Nat. Agric., Grignon, Tome VI., 1915-16.) [63.112.]
- Twenty Years of Agricultural Development in Ireland, *Rt. Hon. Sir T. W. Russell*. (Dept. Agric. and Tech. Instruc., Ireland, Jour., Vol. XIX. No. 2, 1919.) [63(415).]

Dairying and Food, General—

- Variations and Mode of Secretion of Milk Solids, *J. W. Gowen*. (Jour. Agric. Research, 20th January, 1919.) [612.664.]

Engineering—

- The larger Relations of Climate and Crops in the United States, *R. de C. Ward*. (Quar. Jour. Roy. Meteorological Soc., January, 1919.) [551.5.]
- L'Application de l'Electricité, *L. Dabat*. (Travaux et Notices de l'Académie d'Agric., France, Tome I, 1918.) [63.17(04).]

Economics—

- Agricultural Reconstruction, *J. Long*. (Jour. Bath & West & S.C. Soc., 1918-19.) [338.99.]
- Profit Sharing in Agriculture. (Edinburgh Review, January, 1919.) [331.]

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EDITORIAL NOTES.

THE signing of Peace has unfortunately not removed all difficulties in regard to food, as to which, with somewhat

Canning of Fruit and Vegetables.

poor crop prospects, the outlook for the coming winter is not too bright. There is, indeed, every reason to continue the work both of increased production and prevention of waste, and every endeavour should be made to preserve the maximum of fruit and vegetables, produce not required at the moment being stored in one form or another.

Jam-making was general before the War, but bottling and canning were not commonly practised, chiefly because of the impression that these methods could only be carried out under trade conditions. During the War bottling became a recognised method of preserving fruit in large numbers of households, and in some cases thousands of bottles were purchased for the purpose by small allotment and co-operative societies. Canning is, as yet, by no means general, chiefly on the ground that the outfit required is too expensive. This impression is a mistaken one, for the most modest household can improvise the necessary equipment. Canning has certain advantages over bottling, especially if the preserver intends to sell part of the produce. There are no broken bottles; cans bear storage and transport much better; and the method generally is stated to be less expensive and more satisfactory when considerable quantities of fruit and vegetables are concerned. Fruit and vegetables alike may readily be preserved by bottling and canning, delicious and valuable food being thus stored for winter use. Full advice on the subject is given in the Board's Leaflets, No. 250 (*Fruit Bottling for Small Holders*) and No. 331 (*Canning Fruit and Vegetables*), a revised edition of which is in the press.

* * * * *

In the January issue of this *Journal* (p. 1151) reference was made to the importance of the proper preservation and use of farmyard manure. Liquid manure also,

Liquid Manure. consisting of urine and the liquid which drains from the manure heap, is of very great value, when properly conserved and used, in adding to the crop-yielding capacity of the farm, for it contains considerable quantities of soluble plant foods derived during the process of digestion from the various foods consumed by farm live stock. Such residual products have been paid for either directly or indirectly by the farmer, and every endeavour should be made to ensure that they are as fully utilised as may be, and not allowed to drain away and be wasted, as is too commonly the case.

Accounts of liquid manure, and of the construction of liquid manure tanks—which form the most suitable means of holding up for subsequent use the liquid manurial residues of the farmyard—are given at pp. 428 and 431.

* * * * *

A VISIT to the Royal Agricultural Show recently once again revived the thought that the true agricultural show may be regarded as essentially of an educational

**The Educational
Value of Shows.**

character, since the purely agricultural exhibits are all directed to teaching some farmer something—one farmer deriving help from one source, another farmer from a second. The best breeders of stock will confess that they widen their education by competition with their fellow breeders, and by comparison on the spot between the best animals from their respective herds and flocks. The same thing applies to crops, dairy produce, and so forth. The farmer also glean a good deal of information from stands which are held for advertising purposes—from the great steam-ploughing tackle or the farm tractor to the wooden fowl house or the varied uses of concrete. Milking and clean milk production, butter-making, poultry-keeping, bee-keeping, the different classes of farm stock, the thousand and one things which are involved in farming, all were represented at the Royal Show, and the best of everything agricultural is demonstrated by its presence either in competition or for purely exhibition purposes.

There is, however, also an “education exhibition” proper, as an integral part of the Show, and here farmers may learn what is being done to assist agriculture by experiment and research, comparative trial, etc., at the agricultural colleges and research stations. This part of the Royal Show is briefly

d at p. 437.

SINCE the Board's Seed Testing Station was opened late in 1917 much greater interest has been taken in the question of testing samples of seed to ensure that only pure seeds of satisfactory germinating capacity are sown, both farmers and seed merchants submitting large numbers of samples for examination. The 1918-19 seed testing season being now over it will be of interest to state generally to what extent farmers have taken advantage of the facilities offered for testing. In certain counties, notably Anglesea, Stafford, Devon, Montgomery and Cornwall, farmers were very prominent in sending in samples. This seems to have been due chiefly to the work of the County Agricultural Organisers in making the facilities known. This was especially the case in Anglesea, and the method adopted in that county might with advantage be extended to other parts of the country. By this method samples of seed are sent by the farmers to the County Organiser who transmits them to the Seed Testing Station. The reports of the tests are sent to the County Organiser, who hands them on to the farmers and collects the fees—a monthly account being rendered to him by the Station. This entails a slight delay and makes more work for the County Organiser, but it places him in a position to offer advice to the farmer in the case of samples of poor germination.

* * * * *

According to the Report of the Tithe, Copyhold, Commons and Survey Branch of the Board for the years 1915, 1916, 1917 and 1918 [Cmd. 193, price 2d. net.], the total amount of tithe rentcharge extinguished by redemption under the Tithe Acts since the commutation in 1836 up to the end of last year was only £73,579 out of a total apportionment of £4,054,405.

**Increased
Redemption of
Tithe Rentcharge.**

One of the chief objects of the Tithe Act, which received the Royal Assent on the 21st November last, was to facilitate and encourage redemption, and it may be of interest to note to what extent that object is being achieved. During the past six months applications for redemption received by the Board included tithe rentcharges amounting in all to £5,256, which is nearly ten times as much as the amount for the first half of last year and nearly eight times as much as the amount for the pre-war period, January 1st to June 30th, 1914.

In the majority of cases the applicants prefer to pay the consideration for redemption in cash instead of availing themselves of the provision made in the Tithe Act, 1918, for payment by means of an annuity payable yearly or half-yearly for a period not exceeding fifty years.

THE EFFECT OF DRYING ON THE GERMINATION OF CEREALS.

R. G. STAPLEDON, M.A., and MARGARET ADAMS, B.Sc.,

The Seed Testing Station of the Board.

Introduction.—During two seasons at the Seed Testing Station over 13,000 samples of cereals have been tested. The experience gained in dealing with this large number of samples has clearly shown that germination tests on cereals need to be conducted with no less care and attention than do those on smaller seeds such as grasses and clovers. It has been generally held that it is a comparatively easy matter to estimate the value of a sample of grain by careful inspection; the results of tests carried out on samples representative of every county—samples harvested and stacked under the most adverse, as well as under the most favourable, conditions—have shown, however, that this is by no means the case. It is, in fact, not too much to say that the apparent condition of a sample frequently affords little or no index as to its germination. Evidence soon accumulated to show that even a properly conducted germination test might also, under certain circumstances, lead to a totally erroneous estimate of the value of the grain for seed purposes. It was, for instance, found that certain samples, especially such as were received early in the season (*i.e.*, during August and September), did not germinate readily, for instead of 8 to 10 days being sufficient for a reliable test, oats continued to germinate slowly for 2 to 4 weeks and then failed to give satisfactory results, whilst wheat, barley and rye gave germinations at the end of 10 days, which were subsequently proved to be too low, the seed then becoming soft and incapable of growth.

It was thought that the unsatisfactory germination of these samples might have been due to the conditions under which the tests were conducted. A large number of comparative tests were, therefore, undertaken in order to determine the conditions most favourable to germination. These trials confirmed that a relatively low temperature of from 12° C. to 15° C., with a relatively low moisture content of the seed-bed, gave the most satisfactory results in the vast majority of cases. In the case of oats there seemed to be some evidence to show that by fluctuating both the temperature and the moisture content of the seed-bed, germination in some cases tended to be hastened ;

whilst certain samples germinated rather better in the light than in the dark. The behaviour of the samples was, however, erratic, and it seemed wisest to maintain conditions as uniform as possible for the actual tests* and to endeavour to find a simple pre-germination treatment which might be relied upon both to assist and hasten the germination of unsatisfactory or puzzling samples.

It is well known that both the maltster and the miller "condition" their grain by drying; barley being kiln-dried in order to occasion uniform germination. It was, therefore, decided to conduct additional tests on a number of samples: (a) After first drying the grain for three days at 40°C. , the seed being put to dry immediately on its arrival at the Station; this test is referred to hereafter as "after drying." (b) After keeping the grain, without any preliminary drying for about three weeks, in its sample bag in the laboratory; this test is referred to as "after a period." The ordinary test for the sample without drying or keeping for a period will be referred to as "as received."

The method of drying adopted in respect of the tests here described was somewhat different from kiln-drying. When barley is kiln-dried† it is usually brought gradually up to a temperature of about 30°C. to 40°C. , the drying lasting for about 12 hours; or the grain is twice brought up to this temperature, each heating lasting about 12 hours. When dried at temperatures of about 40°C. , it is subsequently spread over a floor and turned from time to time for a further period of 8 to 10 days, and when dried at about 30°C. it is kept in store to "mellow" for about 6 weeks.

Barley does not, however, appear to be very sensitive, and according to J. Mattus will stand a temperature of 60°C. , although Moritz and Morris state that the temperature should not exceed 47°C. The object of "drying" for a longer period than 12 hours at 40°C. was to dry the grain sufficiently without doing it injury, and by obviating the subsequent air-

* The procedure adopted at the Station for testing cereals is as follows:—100 seeds are used for each set, and the average result given by three sets constitutes a test. Glazed earthenware saucers are used, and these are filled with fine sand, which is worked up to a uniform degree of moisture in a zinc bath. The seed is pressed lightly into the sand with a cork. The saucers are placed on top of each other on slate slabs and put away on shelves in the incubating chamber, the seed-bed being lightly sprayed from time to time when the sprouted seed is counted out. This method of testing cereals has proved to be in every way satisfactory, and, in the hands of experienced assistants, gives uniform conditions throughout the testing season.

† The grain is spread out on the floor of the kiln to a depth of about 12 in. and is turned over once or twice during the drying.

drying to be able to get the germination results with as little delay as possible.*

The results of the preliminary tests showed that in many cases the germinations obtained "after drying" and "after a period" were altogether better than "as received." This led to the adoption of the three-fold test as part of the routine at the Station, and throughout practically the whole of the season all samples which gave a poor germination on their first "as received" count were retested "after drying" and (or) "after a period."

It is proposed in this article to give an account of the results obtained on the samples in question. No attempt can, at present, be made adequately to explain the behaviour of many of the samples, but it seems desirable to emphasise the effect that "conditioning" has on germination. "Conditioning" is undoubtedly a question which should receive no less attention from the farmer than from the miller and the maltster, and it is a question, moreover, which demands further exact study, for if it is easy to see why drying should in some cases greatly increase germination, it is difficult to see why in others it should considerably decrease it. Before any method or methods of "conditioning" can be advocated it is, of course, necessary to be able to forecast whether the treatment will prove beneficial or the reverse on any particular bulk of grain that it is required to improve.

It will be convenient (1) to give the results for wheat, barley and rye together, and (2) to deal with oats.

Wheat, Barley and Rye.—The following statement shows in a broad way the effect of drying on these samples :—

WHEAT.—165 samples were tested after drying ; of these :—

32 per cent. gave a germination higher by 3 per cent. or more than the "as received" germination. *The greatest increase was 35 per cent.*

23 per cent. gave a germination lower by 3 per cent. or more than the "as received" germination. *The greatest decrease was 19 per cent.*

45 per cent. gave a germination which did not differ by as much as 3 per cent. from the "as received" germination.

BARLEY.—43 samples were tested after drying ; of these :—

30 samples were received during August and September, and of these :—

27 per cent. gave a germination higher by 3 per cent. or more than the "as received" germination. *The greatest increase was 43 per cent.*

* See *Journal of the Institute of Brewing*. Vol. XX., 1914, and Vol. XXI., 1915, for abstracts of papers by J. Mattus and by E. Weinwurm ; also *Zeitschrift ges Brauw.*, 1914, 37, and *A Text Book of the Science of Brewing* by Moritz and Morris, 1891.

None gave a germination lower by 3 per cent. or more than the "as received" germination.

13 of the samples which were dried were received during October to February; of these :—

35 per cent. gave a germination higher by 3 per cent. or more than the "as received" germination. *The greatest increase was 52 per cent.*

54 per cent. gave a germination lower by 3 per cent. or more than the "as received" germination. *The greatest decrease was 17 per cent.*

11 per cent. gave a germination which did not differ by as much as 3 per cent. from the "as received" germination.

RYE.—25 samples were tested after drying; of these :—

68 per cent. gave a germination higher by 3 per cent. or more than the "as received" germination. *The greatest increase was 20 per cent.*

28 per cent. gave a germination lower by 3 per cent. or more than the "as received" germination. *The greatest decrease was 5 per cent.*

4 per cent. gave a germination which did not differ by as much as 3 per cent. from the "as received" germination.

It must be pointed out that the percentage of samples which showed no appreciable result after drying would certainly have been much higher had it been possible to dry all the samples, instead of chiefly those which gave poor "as received" germinations. An analysis of the figures showed, however, that the proportion of samples which gave an increase as opposed to a decrease as the result of drying was for wheat, barley and rye greater during August and September than later in the season; this was most striking in the case of barley, for the germination of none of the samples received and dried during August and September was appreciably increased by drying. Two rather unexpected results from drying were also apparent, namely, that very considerable increases often took place right up to the end of February, and that samples which had obviously been harvested in poor condition sometimes had their germination much increased, and sometimes much decreased, as the result of drying, thus showing that drying does not only influence newly-harvested and immature grain. Where substantial differences resulted from drying, the greatest increases for wheat, barley and rye were more than twice as high as the greatest decreases.

In order further to appreciate the effect of drying, it is necessary to compare in some detail the results obtained both by drying and by retesting a portion of the samples after keeping the grain for a period of two to three weeks or longer. For this purpose only those samples where substantial differ-

ences from the "as received" germination occurred need be considered. The most striking results are set out in the three tables (Tables I., II. and III.) hereunder, which serve also to indicate how considerable are the effects of both drying and keeping on certain individual samples.

It must be borne in mind that some, or at least a part, of the differences between the "as received," "after drying" and "after a period" tests may have been due simply to the variation in results that cannot be avoided as between test and test, conducted even under identical conditions. This variation is, of course, greatest in the case of samples giving germinations between about 40 and 70 per cent. Every care was

TABLE I.
WHEAT, BARLEY AND RYE.

Cases where Drying increased the Germination and where Keeping for a Period had a similar Effect.

Reference.	Date received.	Percentage Germination.			
		As Received.	After Drying.	After Keeping 2-3 weeks.	Additional Tests.
WHEAT.					
Ca 1	16/8/18 ..	80	95	100	—
Ca 2	16/8/18 ..	84	98	99	—
Ca 2368	29/10/18 ..	45	75	63	—
Ca 2558	2/11/18 ..	63	72	68	—
Ca 2667	6/11/18 ..	60	87	87	—
Ca 2716	8/11/18 ..	63	70	69	—
Ca 2918	22/11/18 ..	85	93	93	—
Ca 2922	22/11/18 ..	78	86	85	—
Ca 2969	28/11/18 ..	69	82	74	Dried for 3 weeks, 86.
					Dried for 5 months, 84.
Ca 2978	30/11/18 ..	63	94	95	—
Ca 2995	3/12/18 ..	86	91	93	—
Ca 3015	6/12/18 ..	54	71	80	After keeping 6 weeks 88, and 6 months 90.
Ca 3022	6/12/18 ..	52	61	68	—
Ca 3023	6/12/18 ..	46	63	68	—
Ca 3046	16/12/18 ..	42	51	51	—
Ca 3071	28/12/18 ..	70	76	83	—
Ca 3082	7/1/19 ..	55	66	74	—
Ca 3164	13/2/19 ..	73	93	93	—
Average figures for Wheat.		64	79 increase = 15	80 increase = 16	—

TABLE I.—continued.

BARLEY.					
Cb 1	8/8/18 ..	47	90	92	After keeping 6 weeks, 99.
Cb 3	17/8/18 ..	79	87	—*	—
Cb 4	19/8/18 ..	66	88	97	—
Cb 5	28/8/18 ..	69	85	95	—
Cb 6	23/8/18 ..	75	96	—*	—
Cb 8	29/8/18 ..	77	96	—*	—
Cb 64	1/11/18 ..	92	97	100	—
Cb 65	4/11/18 ..	29	81	68	After keeping 1 month, 54.
Cb 97	7/12/18 ..	33	36	48	—
Cb 119	30/12/18 ..	83	97	86	—
Average figures for Barley.		65	85 increase = 20	84 increase = 19	—

RYE.					
Cd 1	9/8/18 ..	73	93	93	—
Cd 4	13/8/18 ..	71	91	—*	—
Cd 7	15/8/18 ..	78	89	94	—
Cd 10	21/8/18 ..	86	93	97	—
Cd 165	5/11/18 ..	65	80	69	—
Average figures for Rye.		75	89 increase = 14	88 increase = 13	—

Average figures for Wheat, Barley, and Rye together.		66	83 increase = 17	82 increase = 16	—
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* An insufficient amount of seed was received for conducting these tests.

Notes.—Ca 2368, Ca 2716, Ca 2918, Ca 2922, Ca 2969, Ca 3022, Ca 3023, Ca 3046 and Ca 3071 contained some sprouted grain and were of a more or less mouldy appearance; Ca 2969 contained over 16 per cent. of water; Ca 3015 was described by the sender as being "soft"—it was not, however, of a bad colour, mouldy or sprouted.

Cb 1, Cb 3 and Cb 4 had a somewhat fresh appearance, and were obviously not fully matured. It was ascertained that Cb 4 was cut on 28th July, carried on 12th August, and threshed on the field in time for a sample to be received at the Station on 19th August. Cb 65, Cb 97, and Cb 119 were of a mouldy appearance and in poor condition.

Cd 165 contained some sprouted grain and was in poor condition.

taken, however, in the matter of sample-taking and counting out the sets. The average results given by the large number of samples referred to in the tables and also the very considerable differences in the case of many of the samples do not, however, admit of normal experimental error (which on the average figures would certainly not be as much as 5 per cent.) discounting the general conclusions that are to be drawn.

A study of the tables shows a remarkably constant relationship between the effect of drying and keeping for a period; in the great majority of cases these are in the same direction, and the results obtained by the two methods of "conditioning"

TABLE II.
WHEAT, BARLEY AND RYE.

Cases where Drying decreased the Germination and where Keeping for a Period had a similar Effect.

Refer- ence.	Date Received.	Percentage Germination.			
		As Received.	After Drying.	After Keeping 2-3 weeks.	Additional Tests.
WHEAT.					
Ca 543	21/9/18 ..	87	68	67	—
Ca 1326	7/10/18 ..	78	64	57	—
Ca 1613	20/10/18 ..	87	68	69	—
Ca 1885	18/10/18 ..	33	26	25	—
Ca 1887	18/10/18 ..	81	69	69	—
Ca 2099	22/10/18 ..	90	80	84	—
Ca 2193	24/10/18 ..	82	77	71	—
Ca 2551	2/11/18 ..	90	84	86	After keeping 6 months, 86.
Ca 2722	8/11/18 ..	88	80	78	After keeping 6 months, 79.
Ca 3075	1/1/19 ..	82	70	69	—
Average figures for Wheat.		80	69 decrease = 11	67 decrease = 13	—
BARLEY.					
Cb 78	15/11/18 ..	24	7	7	After keeping 6 weeks, 7.
Cb 102	13/12/18 ..	35	20	27	—
Cb 117	30/12/18 ..	90	83	80	—
Cb 167	22/1/19 ..	65	50	52	—
Average figures for Barley.		53	40 decrease = 13	41 decrease = 12	—
RYE.					
Cd 74	23/9/18 ..	40	37	34	—
Average figures for Wheat, Barley, and Rye together.		70	59 decrease = 11	58 decrease = 12	—

Notes.—Ca 543 contained a little ill-developed grain ; Ca 1326, Ca 1885 and Ca 2099 contained some sprouted grain and were of a mouldy appearance. Cb 78 had the appearance of having been heated in the stack.

are often almost identical even when most considerable (e.g., Ca 1 and Cb 1 increases, and Ca 543 and Cb 117 decreases). It is not easy to account for substantial decreases as the result of drying, and still less to account for a falling off in germination of as much as 13 per cent. (Cb 167) and 21 per cent. (Ca 1326)

TABLE III.
WHEAT, BARLEY AND RYE.

Cases where Drying and Keeping for a Period had dissimilar Effects.

Reference.	Date Received.	Percentage Germination.			
		As Received.	After Drying.	After Keeping 2-3 weeks.	Additional Tests.
WHEAT.					
Ca 278	14/9/18 ..	77	63	76	—
Ca 2548	2/11/18 ..	89	80	90	—
Ca 2719	8/11/18 ..	83	89	80	After keeping 2 months, 88. After keeping 3 months, 75.
Ca 2870	19/11/18 ..	72	64	72	—
Ca 2937	23/11/18 ..	88	83	90	—
Cm 252	11/12/18 ..	89	96	86	—
Average figures for Wheat.		83	79 decrease = 4	82 decrease = 1	—
BARLEY.					
Cb 98	10/12/18 ..	86	84	91	—
RYE.					
Cd 18	31/8/18 ..	64	58	65	Dried for 1 week, 61.
Cd 106	1/10/18 ..	75	69	90	—
Average figures for Rye		69	63 decrease = 6	77 increase = 8	—
Average figures for Wheat, Barley, and Rye together.		80	76 decrease = 4	82 increase = 2	—

Notes.—Ca 2870 was of poor condition, and had a slightly mouldy appearance; Ca 2937 and Cm 252 contained some sprouted grain.

as a result of keeping a sample for as short a period as 3 weeks in the laboratory before testing. It will be noted that these decreases most frequently occurred in the case of samples in poor condition; but by ordinary inspection of the samples it would have been quite impossible to prophesy, for instance, that Ca 2969 and Ca 3015, both in poor condition, would have so wonderfully improved as the result of both the "after a

period " and " after drying " tests, and that Cb 78, Ca 1326 and Ca 1887 would have lost so considerably in germination when subjected to identical treatments. It is only at present possible to state the facts; nevertheless the evidence perhaps suggests that samples that have been badly heated in the stack are incapable of improvement by " conditioning," and lose rapidly in germination capacity; this would at all events seem to have been true of Cb 78. Both the decreased germinations and the irregular behaviour of some of the samples (*e.g.*, results given in Tables II. and III.) may have been due to the drying having been for particular samples insufficient or too drastic, for it has not been possible to ascertain by elaborate trials what temperature is really the best for drying samples under different conditions. The decreased germination as the result of drying may in some cases, however, have been due to the fact that the grain was germinated immediately on removal from the drying incubator at 40° C. and was not subsequently air-dried for 5 to 11 days.

Weinwurm,* for instance, kiln-dried a sample of Moravian barley (water content 18.5 per cent.) at 37° C. for 12 hours and germinated the grain after various subsequent treatments with the following results:—

Percentage Germination in 14 days.

A	B	C	D
The original sample without drying.	Steeped in water for 3 hours immediately after drying.	Exposed to air for 5 days after drying.	Exposed to air for 9 days after drying.
89 per cent.	82 per cent.	91 per cent.	96 per cent.

It is not likely that steeping in water for 3 hours would have decreased the germination of B,† and consequently these figures would seem to show that when decreases occur as the result of drying at 40° C. subsequent air-drying would often occasion decided increases. The behaviour of Cd 106, which dropped 6 per cent. as the result of drying and gained 15 per cent. when kept for 3 weeks although not previously dried, and also of Cb 98 and Ca 2937, may, perhaps, be thus accounted for.

In the hope of throwing further light on the reasons for decreased germination, it was decided to ascertain the effect of drying on (a) Ill-developed or "pinched" grain, and (b) Sprouted grain.

* See footnote, p. 366.

† Tests conducted in connection with this work did not suggest that soaking in water decreased germination.

(a) ILL-DEVELOPED OR "PINCHED" GRAIN. — Several samples were received which, although containing from 50 to 80 per cent. of "pinched" grain, none the less germinated over 90 per cent. Ca 2592 was a sample in point which contained 57.6 per cent. of "pinched" grain (18.2 gr. per 1,000) and 26.2 per cent. well-formed grain (26.2 gr. per 1,000) with 3.7 per cent. broken seed and germinated 90 per cent. The "pinched" and good grain were also germinated separately both "as received" and "after drying"; the results were as follows:—

		"As received."		"After drying."
		Per cent.		Per cent.
Good grain	.. ..	90	.. ..	85
"Pinched" grain	.. ..	88	.. ..	83

These figures suggest that the behaviour of the "pinched" grain in a sample is very similar to that of the good grain.

(b) SPROUTED GRAIN.—Ca 1048 contained 37 per cent. of sprouted grain and 63 per cent. of unsprouted grain. These were germinated separately both "as received" and "after drying," with the following results.

		"As received."		"After drying."
		Per cent.		Per cent.
Sprouted	.. ..	58	.. ..	6
Unsprouted	.. ..	99	.. ..	97

Ca 2969 contained 10 per cent. of sprouted grain. This was separated into three grades, each of which was germinated separately, both "as received" and "after drying," with the following results:—

		"As received."		"After drying."
		Per cent.		Per cent.
1. Long roots and distinct plumule (green)	.. ..	16	.. ..	0
2. Roots fully developed but no plumule	.. ..	20	.. ..	4
3. Slight protruding of radicle	.. ..	46	.. ..	32

It will be noted from Table I., that this sample as a whole benefited from drying to the extent of 13 per cent., so that the 90 per cent. of non-sprouted grain very considerably benefited, whilst the 10 per cent. of sprouted grain suffered. The above examples clearly show that sprouted grain as such cannot stand drying, consequently when really considerable amounts of sprouted grain (say over 30 per cent.) occur in a sample, the germination will almost of necessity fall off as a result of this treatment. It would seem evident, therefore,

that excess of sprouted grain in samples would sometimes be sufficient to account for a falling off in germination as the result of drying, but that the erratic behaviour of the samples under review must have been due to more obscure causes.*

It was thought that samples in a very wet condition might be adversely affected by sudden drying, even at 40° C. A number of samples were, therefore, soaked for 3½ hours in water and then immediately dried; the results did not indicate any particular harm, although quite excellent samples soaked in salt solution and then immediately dried did, in some cases, lose as much as 10 to 17 per cent. in germination, in spite of the fact that when planted wet directly after soaking, their germination was in no way impaired.

It will be noted that in the majority of cases given in Table III., the "after a period" test was very similar to the "as received," and that with the exception of Cd 106 (previously referred to) the irregularity of the results was due rather to the increase or decrease as the result of drying not being borne out by a corresponding increase or decrease as the result of keeping—that is to say, drying had a more or less marked result, while keeping had no particular effect. If, however, substantial increases or decreases only are considered, it will be seen that out of 56 samples, only 8 gave increases or decreases of 5 per cent. or over as the result of drying, *which were not borne out by the "after a period" test*, whilst 46 gave increases or decreases of 5 per cent. or over and 32 gave increases or decreases of 10 per cent. or over as the result of drying, *which were also borne out by the "after a period" test*. It is thus evident that the "after drying" test is a very fairly reliable one, and in the case of wheat, barley and rye gives a valuable indication as to the potential quality of the grain, and that even if this test is not supplemented by an "after a period" test, the risk of doing serious injustice to any appreciable number of samples is not very great. It would not, however, be sufficient to substitute the "after drying" for the "as received" test, but both these tests are necessary in all cases where the "as received" test gives poor results. The adoption of the "after drying" test thus appears to be the easiest and best means of dealing with difficult samples of wheat, barley and rye.

Oats.—The number of oat samples which, especially early in the season, gave unsatisfactory "as received" results was

* Only a few of the samples referred to in the tables contained as much as 10 per cent. of sprouted grain.

no less considerable than in the case of wheat, barley and rye. It has been said that oats, especially early in the season, took much longer to germinate than other cereals. The length of time taken for the completion of the "as received" tests on samples received during August and up to the middle of September is well illustrated by the following figures:—

(a) BLACK OATS.

83 4 per cent. took less than 10 days.

28 " " about 10 "

50 " " " 14 "

18 " " over 21 "

(b) GREY OATS.

43 per cent. took less than 10 days and generally no more than 7 days.

52 " " about 10 days.

5 " " over 10 days but less than 14 days.

It will thus be seen that black oats on the average were much slower germinators than grey, and later in the season they proved more often to be slower than white.

The poor energy of germination of certain samples of oats early in the season is shown by the following figures, which also indicate that the germination is much faster when the samples are kept for a period before being put up to germinate.

Reference and Date received.	Treatment.	Germination per cent.				
		In 6 days.	In 12 days.	In 18 days.	In 24 days.	In one month
Cc 2, 8th Aug., 1918	As received.	4	10	50	56	56
	After keeping 2 weeks	16	45	60	78	82
	" " " " *	20	63	96	96	96
Cc 3, 15th Aug., 1918	As received.	49	57	70	86	90
	After keeping 2 weeks	69	80	88	91	91

* This test was conducted on a further sample drawn from the same bulk as the original sample.

The above figures show that a report based on a 12-day test would have been quite erroneous, that a 12-day report after keeping the grain would have been more accurate, but that even this figure would not have done the samples full justice.

The drying of oats for 3 days at 40° C. did not produce such striking results as in the case of wheat, barley and rye, for, out of 100 samples so dried during August and September, only 5 per cent. gave germinations higher by 3 per cent. or more than the "as received" figure. The greatest increase obtained

was only 14 per cent., as against over 30 per cent. for wheat, over 40 per cent. for barley and 20 per cent. for rye ; decreases in the germination of oats as the result of drying were of negligible occurrence. It is desirable to test further the effect of drying oats, for the drying test has the advantage over the " after a period " test in that it does not materially delay reporting. It is possible that the unsatisfactory results of the drying at 40° C. as compared with the period test may have been due to the fact that 40° C. is not in the case of oats the most satisfactory temperature for the purpose. A few samples were dried for 20 minutes at 80° C., and showed no particular result ; two were dried for 5 hours at about 80° C., one dropped somewhat in germination ; whilst samples dried at 60° C. for an hour were unaffected. There was not time, however, to investigate fully the question of temperature, and consequently the drying test was abandoned and unsatisfactory samples were only retested after keeping for a period.

It was found that after about the end of January it was only occasionally that substantially better results were obtained by retesting after keeping the grain for 3 weeks. Fifty samples were retested after keeping for a period between August and January ; of these—

54 per cent. gave a germination higher by 3 per cent. or more than the " as received " figure ; 26 per cent. was the greatest increase.

19 per cent. gave a germination lower by 3 per cent. or more than the " as received " figure ; 11 per cent. was the greatest decrease.

27 per cent. gave results that did not differ by as much as 3 per cent. from the " as received " figure.

It is thus seen that keeping for a period may have nearly as great an effect in increasing the germination of oats as it has on wheat, barley and rye, but that substantial decreases apparently seldom occur in the case of oats. Thus oats differ from wheat, barley and rye, in that substantial decreases in germination as the result of either drying or keeping for 3 weeks are of very infrequent occurrence, while greater and more uniform increases follow *keeping* than *drying*.

The most striking results obtained for individual oat samples are set out in the subjoined tables (Tables IV. and V.)

It will be noted that the greatest increases occurred in the case of obviously insufficiently ripened samples received early in the season, Cc 2 increasing in germination from 56 per cent. to as much as 96 per cent. after it had been kept for one month.

TABLE IV.

OATS.

Cases where Keeping for a Period increased the Germination.

Reference.	Date Received.	Colour of Oat.	Percentage Germination.			
			As Received.	After Keeping 2-3 weeks.	Additional Tests.	After Drying for 3 days at 40° C.
Cc 2	15/8/18	Black	56	82	After keeping* 1 month, 96.	62
Cc 6	21/8/18	Black	89	97	—	94
Cc 9	21/8/18	Black	83	96	—	97
Cc 13	28/8/18	Black	89	95	—	94
Cc 32	6/9/18	Black	81	100	—	90
Cc 33	6/9/18	Black	85	98	—	96
Cc 36	6/9/18	Black	93	98	—	91
Cc 70	12/9/18	Black	85	97	—	96
Cc 95	16/9/18	Black	85	—	After keeping 6 weeks, 100.	96
Cc 133	19/9/18	White	58	70	After keeping 6 months, 69.	65
Cc 285	8/10/18	Black	48	51	—	—
Cc 468	29/10/18	Black	80	95	—	—
Cc 483	30/10/18	White	85	92	—	—
Cc 485	30/10/18	White	87	94	—	—
Cc 531	7/11/18	White	88	94	—	—
Cc 594	26/11/18	White	37	46	After keeping 3 months, 45.	—
Cc 709	20/12/18	White	78	94	—	—
Cc 710	20/12/18	White	81	97	—	—
Cc 711	20/12/18	White	87	97	—	—
Cc 712	20/12/18	White	85	98	—	—
Cc 713	20/12/18	White	82	97	—	—
Cc 714	20/12/18	White	83	97	—	—
Cc 715	20/12/18	White	80	96	—	—
Cc 727	24/12/18	Black	68	75	—	—
Cc 728	24/12/18	Black	64	67	—	—
Cc 1177	30/1/19	White	73	81	—	—
Average germination of all the samples.			77	88 increase = 11	—	87 increase = 10

Notes.—Cc 133, Cc 594 and Cc 727 were of a mouldy appearance.

* This test was made on a second sample drawn from the same bulk as the first, the grain originally sent not being sufficient for all the tests.

Samples received later in the season, many of which were in poor condition, also in several cases improved for being kept for no longer than three weeks, that is to say, they were considerably improved as the result of air-drying.

The majority of the substantial advances occurred in black oats; many samples of white oats, however, much benefited by keeping. The only case where a decided decrease took place was Cc 665, which was of a very mouldy appearance, but as with wheat, barley and rye, it would have been impossible to foresee that this sample would have decreased rather than increased in germination.

TABLE V.

OATS.

Cases where Keeping for a Period decreased the Germination.

Reference.	Date Received.	Colour of Oat.	Percentage Germination.		
			As Received.	After Keeping 2-3 weeks.	Additional Tests.
Cc 367..	12/10/18 ..	Black ..	85	80	—
Cc 544..	11/11/18 ..	Black ..	77	74	After keeping 6 weeks, 70.
Cc 620..	1/12/18 ..	White ..	87	81	After keeping 6 weeks, 81.
Cc 624..	1/12/18 ..	Black ..	68	65	—
Cc 665..	10/12/18 ..	White ..	79	68	—
Average germination of all the samples.			79	74 decrease = 5	—

Notes.—Cc 367 and Cc 665 were of a mouldy appearance.

Summary.—The evidence brought forward may be considered from two points of view, namely, as it affects routine seed testing, and as it bears on the problem of "conditioning" grain. From the point of view of "conditioning" it would seem that there is some risk in sowing wheat, barley, rye and oats, even when the grain is manifestly sound, early in the autumn and immediately after thrashing. In many cases, no doubt, the grain would "sweat" sufficiently in the soil before it commenced to germinate; but if the weather conditions were adverse it is more than probable that the grain would at best germinate irregularly, or, perhaps, much below what it should do, and that an irregular plant would result. It would be a wise precaution, therefore, to test before use, samples required for sowing immediately after thrashing and if necessary, either to kiln- or air-dry the bulk for a sufficient period.

Kiln- and subsequent air-drying for a few days may probably be relied upon under these circumstances in the case of wheat, barley and rye, but it is doubtful if it would prove so successful with oats. In the case of black oats in particular, it would in all probability frequently be better to air-dry the grain by turning over on the floor of a barn at regular intervals for two or three weeks rather than to sow too soon after thrashing.

The question of the advisability of "conditioning" grain which is obviously not perfectly sound is more difficult, for it has been shown that either artificially drying or keeping the grain for a period in a cool place may, in certain cases, result in a decrease of germination. It is probable that corn that has been badly heated in the stack, or of which the larger proportion of the grain is sprouted, can under no circumstances be improved by "conditioning" and can only further deteriorate as time goes on. Grain that has been harvested and carried under adverse conditions, and is weathered, but not seriously heated or very much sprouted, can, however, sometimes be greatly improved by drying, and if it is intended to use such grain for seed, the chances are in favour of an increased germination resulting from careful air-drying on the floor of the most airy place available. The evidence, therefore, suggests that grain of this character should not be stored in bags or large heaps, but rather in small heaps that can be easily turned. There is little doubt also that in wet districts and especially after bad seasons it would be a great gain if farmers had facilities for kiln-drying their wheat, barley and rye immediately after thrashing and before storing the grain.

From the point of view of testing cereals and estimating the probable value of a sample to the farmer, the results obtained have a decided significance. It is evident, for instance, that the figures obtained after keeping such samples as Ca 1, Cb 1, and Cd 1 and Cc 2, for three weeks, or after drying them, much more accurately represent the commercial value of the samples than the "as received" figures. It would, therefore, be dangerous to report "as received" figures on obviously sound samples early in the season. It does not, of course, follow that samples stored in bags or in large heaps would necessarily approximate to the dried or "after a period" figures in the comparatively short time that must elapse for conducting these tests, and consequently both the "as received" and "after drying" results should be reported to the farmer, so that he may, if necessary take steps to air- or kiln-dry the bulk of his corn.

In a general way, too, the "after drying" and "after keeping" tests are informing all through the season, for, if a sample shows a substantially lower "after drying" than "as received" result, this may usually be taken as an indication that the sample in question is a deteriorating one, or at all events that it is not likely to benefit very materially by "conditioning." In the case of samples in obviously poor condition, and such as are received later in the season, it is probable that the "as received" germination most nearly represents the commercial value of the grain. For instance, Ca 2978 and Ca 3015 would probably not have improved very greatly and would more likely have further deteriorated if allowed to stand in bulk, but would only improve if carefully kiln-dried or carefully spread out and turned on a barn floor. A farmer receiving an "as received" and "after drying" report on either of these samples would be foolish indeed to use the grain for seed without first "conditioning" the bulk. From what has been said, it is certain that very misleading results would often be obtained on cereals if reliance were only placed on the "as received" tests. It is necessary, therefore, to supplement the "as received" test with at least an "after drying" test for wheat, barley and rye and an "after a period" test for oats in the case of such samples as give unsatisfactory first results.

It is hardly necessary to emphasise the fact that germination only has been considered in this paper; the effect of drying or heating on the growth of the plant is an entirely separate problem. It should, perhaps, be pointed out also that the word "drying" has throughout been used in a relative sense. The moisture content of the majority of the samples tested has, of course, been high, often from 16 to at least 20 per cent.* The object in view has been to test the influence of reasonable "conditioning" on germination, and no endeavour has been made to test the effect of desiccation, which is a totally different problem.

In conclusion it may be remarked that the work described makes no claim to be exhaustive—it was conducted during the height of a busy season, and, consequently, it was impossible to estimate the water content of the individual samples, or to attempt anything in the nature of a microscopical or chemical

* Saxby states that the average moisture content of English wheat is 17 per cent. with a range of 15 per cent. to 19 per cent.; while many foreign wheats have a moisture content of 9 to 13 per cent. See "The Storage of English Wheat," by F. W. Saxby. *The Journal of the Bath and West and Southern Counties Society*, Fifth Series—Vol. XII., 1917-18.

study of the grain. It is evident, however, that the phenomena described are worthy of detailed research ; and it is to be regretted that the matter cannot at present be followed up at the Seed Testing Station, for the reason that a complete investigation of the problems involved could only be conducted contemporaneously with the receipt of the samples. From the nature of the case, therefore, it is not a problem that can be worked at during the " slack season," and, unfortunately, it is a problem that can only be elucidated by the handling of numerous samples.

DRAINAGE OPERATIONS IN NORFOLK.

A NUMBER of drainage operations have been initiated and carried out by the Norfolk War Agricultural Executive Committee with the aid of German prisoner labour. The operations may be dealt with individually as follows :—

I. River Waveney.—The operations on the River Waveney constitute the biggest individual scheme carried out by the Committee. The Waveney Valley has long been subject to frequent and serious flooding, and the attention of the Norfolk and East Suffolk Committees was soon called to the preventable damage caused to the low-lying meadows, which should be of considerable value.

In the year 1866 an Act was passed setting up a Commission to deal with the river from Beccles to Hoxne, with power to control mills and other obstructions. Very little work was ever done by this Commission, however, and, after raising by rate the heavy cost of obtaining the private Act of Parliament, their powers gradually fell into disuse. Their rating powers extended over an area of about 5,000 acres.

In the summer of 1917 the East Suffolk and Norfolk Committees took over (under D.O.R.A.) the powers of the Commission, and the Norfolk Committee undertook to organise and carry out the necessary work.

A camp of 75 prisoners (increased later to 110) was formed on Bungay Common, Mr. Hobrough was engaged as engineer (under the supervision of the Committee's Executive Officer, Mr. Giles) and undertook to find foremen and tools.

Work began at Bungay in September, 1917, and the river from that point upwards (including main relief cuts) was cleared of shoals and weeds, corners were eased off, trees in

the channel were removed, banks were made up, mill dams were cleared, and the channel was restored as far as manual labour could effect it. Up to the end of the camping season of 1917, four miles of main river and half a mile of relief cuts had been cleared.

In the winter prisoners were accommodated at Shipmeadow Workhouse, and the necessary walk to Ellingham station reduced working hours. In July, 1918, Bungay camp was reopened, and work progressed up to and above Homersfield as far as Mendham, where from 2 to 3 ft. of deposited mud had to be practically dug out in order to reach the original river bed. At this point work from Bungay became impossible, and the camp was closed in November, 1918. No suitable winter accommodation could be found, and work had, therefore, to be stopped on that length pending a 1919 summer camp.

Forty of the prisoners were, however, moved to maltings at Billingsford, the number being subsequently increased to 150, and, with the co-operation of landowners, work was started from Hoxne upwards (above the limits of the Waveney Commission) and has now been carried about 3 miles further, to a point above Scole Bridge. In addition, half a mile of the old river has been cleaned out.

In the meantime the Executive Committee has applied to the Board of Agriculture to form a Drainage Board with power to deal with the whole river, the cost of the work to be subsequently recovered by rates to be raised by the new Drainage Board.

The Committee applied for a camp to be formed at Needham to complete the work in the gap between Mendham and Hoxne, but the War Office have decided not to open any new camps, and it has not been found possible to arrange transport from existing camps. This length needs attention, but it is, on the whole, not so badly congested as were other portions of the river on which the work described has been done.

Naturally a winter like that of 1918-19 resulted in floods, but local information is agreed that the water has never previously run off so quickly, and that the work has had most valuable results.

It should be noted that Messrs. W. D. & A. E. Walker, Ltd., owners of the navigation below Bungay, have carried out extensive dredging operations, and that the Committee provided 12 prisoners to assist in the manual labour. The Committee also provided labour for the riparian owners to

clear out Wortwell main drain ($1\frac{1}{2}$ miles) which discharges into the river above Homersfield.

Summary to Lady Day, 1919—

Miles of river and main channel cleansed, 14.

Number of hours worked, approximately, 211,421.

Cost of supervision and tools, £905 8s. 1d.

For photographs showing the condition of this river before and after the work, See Figs. 1-8.

2. River Tas and Upper Yare.—The Committee's powers of enforcing cleaning of rivers only applying to occupiers of frontage lands, the Committee called a meeting of landowners in July, 1917, and a Committee was appointed under the chairmanship of Sir Eustace Gurney to finance the work and pay for tools, plant and supervision; but, as in the case of the Waveney, prisoner labour was obtained free of charge.

A camp of 80 prisoners was formed at Markshall early in September, 1918, and work commenced at Trowse. After the worst of the shoals and weeds up to Lakenham had been removed work was carried from that point up to the Tas, and, by the end of the camping season at the beginning of November was completed, with very marked results, to Markshall Bridge.

No suitable accommodation could be found for the full number of prisoners, but 25 were accommodated for the winter at Lakenham Mill, from which place the work was first continued on the Tas up to Stoke Mill Dam, and as this was the limit of the permitted walking distance from Lakenham camp, work was then started on the Yare above Lakenham Mill. At the time this report was written the prisoners were busily engaged in removing the large accumulation of mud from the mill dam and the reach above it.

The cost of cleaning out the river between Trowse Mill and Lakenham Bridge, including the mill dam, and of tools and supervision, averaged about £10 per mile frontage. The total amount expended on both rivers up to 3rd May, 1919, was £240 19s. 5d.

3. River Thet.—The Committee in 1917 obtained a report from Mr. Hobrough as to the existing state of the river, which showed the need for comprehensive dealing with mud, weeds, fallen trees and other obstructions. They were fortunate in securing the voluntary services of Mr. Walter Kerridge, of East Harling, who undertook to organise the riparian owners and carry through a scheme at the expense of the owners. The Committee were, however, able to obtain prisoner labour free, so that the cost, although heavy, has been materially reduced.

Mr. Kerridge, after getting the consent of the various owners, employed a competent foreman and started work in September, 1917, with 20 German prisoners from the Kenninghall camp. The work has progressed more or less steadily from that time, and still continues.

The total length of the river from Melford Bridge, Thetford, to the Red Bridge, Shropham, is about 16 miles, and between 2,000 and 3,000 acres of low-lying land have been immensely improved by the work; and owing to the clearing of the river some landowners and occupiers have taken the opportunity of clearing out side drains and dykes at their own expense.

Up to April, 1919, the total cost, including supervision in clearing the main river, has been approximately £430. The number of men employed for a period of 18 months has varied from 20 to 9 (average, say, 14).

Some stretches of the river were in an exceedingly bad state; some of the mud shoals removed were 200 yd. long and 5 yd. wide (one in particular taking 14 men a fortnight to dig out).

Owing to the very wet weather experienced during the autumn and winter of 1918-19, a great deal of time has been lost (only 31 days were worked during December, January and February.)

4. River Wensum.—In this case also the Executive Committee enlisted the services of a committee of landowners, and after long negotiation with the authorities were able to obtain a depot for 110 German prisoners, housed at Whitwell in August, 1918. Sir Eustace Gurney was Chairman of this Committee also, and the Committee were fortunate in obtaining the services of a qualified engineer, Mr. Vernon Price, to act as Hon. Secretary and Superintendent.

The prisoners were railed to Hellesdon, where work was started above the mill. The mill dam was run dry and the accumulated mud removed to the bottom of the original river bed, after which work was carried up the river, all shoals and weed beds being removed. At the same time, the River Tud in its lower reaches, from the point where the Wensum Soak drain joined the smaller river, was cleaned out, the upper part of the Tud having been already dealt with by Orders served by the Committee on the occupiers.

In order that work might be commenced at more points than one, another depot was formed at Elmham, but unfortunately a great delay occurred in the formation of the camp, which was only opened on 26th March, 1919. Work has started at Elsing. If this camp could have been opened earlier there is no doubt that all the worst stretches of the river from Norwich



FIG. 1.—River Waveney, Homersfield. Before the cleansing.



FIG. 2.—River Waveney, Homersfield. After the cleansing.



FIG. 3.—River Waveney, Homersfield. Before the cleansing.



FIG. 4.—River Waveney, Homersfield. After the cleansing.



FIG. 5.—River Waveney, Billington. Before the cleansing.



FIG. 6.—River Waveney, Billington. After the cleansing.



FIG. 7.—River Waveney Billington. Before the cleansing.



FIG. 8.—River Waveney Billington. After the cleansing.



FIG. 9 —Snettisham. Before the cleansing.



FIG. 10 —Snettisham After the cleansing.

to Fakenham could have been dealt with, and a foundation laid for easy maintenance by the Drainage Board, for the formation of which the Committee have already applied to the Board of Agriculture.

5. **Soarrow Beck, Aldborough.**—The German prisoners began work on the above stream on 26th May, 1918, and finished on 26th March, 1919; here also their work was obtained free of charge.

The total distance cleared amounts to approximately 1,100 chains, or $13\frac{3}{4}$ miles. The cost of this work was £103 12s. 1d.—about 1s. 10d. per chain. This sum represents the amount which the adjacent owners will have to pay for wages to the ganger, the cost of boots, and the price paid for tools, etc.

The work has been well done, and an area of some 3,500 acres has greatly benefited; the good effect of the work is already being felt, and as time goes on will become more apparent. All trees, bushes and other obstacles have been removed from the banks of the stream and the mud thoroughly cleaned out.

In the Aldborough Mill Dam (which has also been cleaned out) the mud was about 4 ft. 6 in. deep in most places. All of it was removed at a total cost of £48, the whole of which was borne by the owner of Alborough Mill.

6. **Hundred Stream.**—This work, which was carried out by a private landowner at his own expense, with a migratory gang of prisoners, has now been practically completed from the Dilham Canal to the new bridge between Honing and East Ruston. It has also been completed about two-thirds of the way to the corner of Crostwight by Potter's Grove, and the stream has been opened out and the mud removed up to and for about 200 yd. beyond Potter's Grove Corner. Even after the heavy rains and the consequent high water, the level has been lowered by quite 1 ft., and it is anticipated that in summer and after dry periods it will be down about 2 ft., thus making Ruston Fen and the Fen land on Honing Severals practically dry. The full benefit of this work, however, will not be obtained unless the Dilham Canal is freed from the shoals which obstruct it.

7. **Burnham Drainage.**—In the course of the voluntary survey undertaken by the Norfolk valuers in 1917, Mr. J. M. Wood drew special attention to a neglected area of marshes at Burnham, draining by way of numerous ditches through

the Burnham River into the sea, and he subsequently offered, if labour could be found, to organise a voluntary scheme with owners and occupiers to carry out the necessary improvement.

Application was accordingly made by the Committee, and a camp of 75 German prisoners was formed at Burnham in the month of October, 1917. Work was commenced under Mr. Wood's supervision, he undertaking all the organisation and clerical work in obtaining contracts by landowners, etc., to pay for the work, and at his own expense obtained the necessary tools and plant to enable the work to be started. The camp was moved for the winter to buildings at Burnham. The work at Burnham was finished in October, 1918.

Five and a quarter miles of the main river, including 3 mill dams, were completely bottomfyed, banks made up and about 14 miles of subsidiary drains were bottomfyed and brinked, resulting in a most valuable improvement to the whole area.

To get full benefit from Mr. Wood's valuable work, it is essential that the sluices at the outfall be put in proper working order, and in order not to allow the area to revert to its former condition the Committee have applied to the Board of Agriculture to set up a Drainage Board for the area.

The daily average of men employed for a period of 12 months was 48, and the total cost of the work has been £2,517 14s. 5d., which, however, has been reduced by the remission of the charge for a certain portion of the prisoner labour employed in cleaning the main river.

8. Snettisham Drainage.—In this case, also, Mr. Wood undertook a scheme on the same lines as that of Burnham, and the work was carried on continually from a camp at Snettisham, beginning in December, 1917.

Upwards of 54 miles of ditches and drains have been cleansed, and it is hoped that here also landowners and tenants will see that the improvement is maintained.

Mr. Wood has produced very striking photographs taken from the same point, one before and one after the execution of the work, showing the degree to which flooding has been eliminated and the water level lowered (see Figs. 9 and 10).

The daily average number of men employed on this work has been 43, and the total cost to date is £3,359 4s.

9. Little Ouse or Brandon River.—During the latter part of the year 1917, Mr. Varipati bought this Estate, and his attention was at once turned to the improvement of the Little Ouse River, dykes and other waterways.

German prisoners were at once employed on the work, which at the time had to be paid for. After Mr. Varipati had spent several hundred pounds a joint request was made by the riparian owners for free labour. This was granted in November, 1918. His Grace the Duke of Grafton, Mr. J. Musker and Mr. Varipati subscribed liberally towards the cost of tools and supervision; Thetford Town Council and the River Carnival Committee have also rendered valuable assistance.

When the work was taken over, the Little Ouse River and its tributaries were almost completely grown up with reed beds. Long stretches have been entirely dug out from the Nuns' Bridge for some distance on the Duke of Grafton's estate, as well as at Rushford.

On the other side of Thetford, from Two Mile Bottom upwards, a large amount of weed cutting is still being done. The result has been a great improvement to several hundreds of acres of land, especially on the low-lying meadows.

VALUE OF BLAST FURNACE DUST AS A POTASH MANURE: REPORT ON FIELD TRIALS.

Report prepared by the Agricultural Education Association.

THE most abundant source of potash available for agriculture in the country during the past two years has undoubtedly been Blast Furnace Dust.

[The fact that this material was being placed on the markets in fairly large quantities in the autumn of 1917 was brought to the notice of the Chemistry Committee of the Agricultural Education Association, and they decided that it was extremely desirable that field trials should be carried out in 1918 with a view to determining the agricultural value of the potash in this material as compared with the pre-war German sulphate of potash, and also the possibility of harmful effects being produced by the use of the dust.

The Association having approved the proposals for experiment, the Food Production Department of the Board of Agriculture and Fisheries were approached in the matter, and

they offered to defray the necessary expenses of carriage and distribution of the manures to the centres.

The Blast Furnace Dust was given by Mr. E. P. Davis of the Bennerley Furnaces, Ilkeston, to whom the Association are much indebted, whilst the German sulphate of potash was purchased by the Food Production Department from a pre-war stock in this country.

It is not proposed to describe the origin and production of Blast Furnace Dust in this Report, as an account has already been published in this *Journal* for August, 1917, p. 526.

Crops.—It was decided to confine the trials to two crops, viz., potatoes and mangolds, it being considered that these were the most suitable for the experiment in view.

Centres.—Districts were selected where land was known which would generally give a definite response to potash manuring. Sixteen centres were ultimately arranged, as follows :—

<i>County.</i>	<i>Centre.</i>
Cambridgeshire ..	University Farm, Gravel Hill, Cambridge.
Devonshire ..	(a) Woodwater, Heavitree. (b) Bridford Barton.
Edinburgh ..	Liberton Mains, nr Edinburgh.
Essex ..	Chelmsford.
Hertfordshire ..	Rothamsted Experimental Station.
Kent ..	S.E. Agricultural College Farm, Wye.
Monmouthshire ..	Mon. Agricultural Institution Farm, Usk.
Nottinghamshire ..	Midland Agric. College Farm, Sutton Bonington.
Shropshire ..	Harper Adams Agricultural College Farm, Newport.
Suffolk ..	(a) Oakley Park Farm, Eye. (b) Nocton.
Warwickshire ..	The Farm Institute Farm, Marton.
Worcestershire ..	(a) Lincombe Farm, Stourport. (b) Parkmore Farm, Hartlebury.
Yorkshire ..	Menagerie Farm, Escrick.

Plots. The following instructions issued by the Committee were, as far as possible, strictly adhered to by the various experimenters :—

All plots to be in duplicate, to be exactly one-twentieth of an acre and to include—

1. Control (no added Potash).
2. Low Grade Dust.
3. Medium Grade Dust.
4. High Grade Dust.
5. Water Extracted Dust.
6. German Sulphate of Potash.
7. Medium Grade Dust (intermediate application).
8. „ „ „ (late application).

Time of Application.—For Plots 2 to 6 as early as possible ; for Plot 7 intermediate between earliest application and time of sowing ; Plot 8 at time of sowing. All plots to receive a basal manuring of nitrogen and phosphates, and of dung where it is considered that a fair crop cannot be obtained without, but in any case not more than 10 tons of dung per acre to be applied.

At a few centres late delivery of the manures necessitated Plots 7 and 8 being dressed at the same time as the other plots.

Each experimenter was asked to observe carefully the crops during growth, and to record any variations which might be due to toxic effect on the part of the Blast Furnace Dust.

Analysis of Manures and Quantities applied.

Manure.	Percentage of Potash (K ₂ O).	Quantity per 1/20 acre Plot.	Approximate Quantity per Acre.
		Lb.	Cwt.
Low Grade Dust ..	2.21	124	22
Medium Grade Dust ..	5.85	47	8½
High Grade Dust ..	8.90	30½	5½
Extracted Dust ..	7.37	37½	6½
Sulphate of Potash ..	50.24	5½	1

The quantities applied were calculated on the basis of 1 cwt. of sulphate of potash (49 per cent. K₂O) per acre. The percentage of potash in the manures was determined by the Fertilisers and Feeding Stuffs (Method of Analysis) Provisional Regulations, 1918. The various dusts were tested for ferrocyanides and thiocyanates, but these substances were not present in any of the samples.

Interim Reports.—During the summer the experimenters were asked to send in reports on the growth of the crops, and the points elicited were as follows :—

Cambridge	..	No Remarks.
Devonshire	..	"
Edinburgh	..	No marked difference between the plots.
Essex	..	No remarks.
Hertfordshire	..	Plots 2, 3, and 6 rather behind control. Plots 4 and 5 equal to control. Plot 7 best of the whole set. Plot 8 not so good as Plot 7.
Kent	..	No differences noticeable.

Monmouth	..	No remarks.	
Nottinghamshire	..	..
Salop	..	..
Suffolk	..	..	No differences noticeable.
Warwick	..	..	..
Worcester	..	..	..
Yorkshire	..	..	..

At no centre was any toxic effect noticed, and in the majority of cases it was impossible to distinguish one plot from another, either on the potatoes or the mangolds.

Final Reports. *Potatoes.*—Table I. gives the yield per acre for each plot, and the average of the duplicates.

Table II. gives the relative yields on the manured plots as compared with the control plot.

Mangolds.—Table III. gives the yield per acre for each plot and the average of the duplicates.

Table IV. gives the relative yields on the manured plots as compared with the control plot.

In these tables only those centres are included where a response to potash manuring was recorded. The results at the remaining centres will be found in the Appendix.

Since the value of potash as a fertiliser for many crops, including potatoes and mangolds, has been so well established in the past, *it is rather surprising that so many centres failed to show a response.* It appears likely that the following points contributed towards these failures:—

1. Unsuitable land—

- (a) Sufficiency of potash already present.
- (b) Too heavy dressing of dung applied.
- (c) Land not of a uniform character.

2. Prolonged drought during summer.

3. Late application of the potash manures in some cases, owing to delay in transit.

Conclusions.—*Potatoes.*—On referring to Table II. it will be seen that the Extracted and High Grade Dusts have undoubtedly given the best results, followed by the Medium Grade Dust and the Sulphate of Potash. The Low Grade Dust has produced the worst result. The Plots (7 and 8), on which

TABLE I.
Potatoes.
Yield in Tons per Acre.

No. of Plot.	Potash Manure Applied.	Shropshire.	Worcester (Lincombe).	Devon (Woodwater).	Devon (Bridford Barton).	Suffolk (Eye).	Yorkshire.	Monmouth.	Suffolk (Nocton).	Cambridge.
1	Control	A. 14.7 { 13.55 B. 12.4 }	A. 8.4 { 9.25 B. 10.1 }	A. 6.2 { 6.35 B. 6.5 }	A. 10.7 { 10.85 B. 11.0 }	A. 15.3 { 14.9 B. 14.5 }	A. 12.9 { 11.75 B. 10.6 }	A. 9.6 { B. 4.9 }	6.8	15.5
2	Low Grade Dust	A. 12.6 { 12.65 B. 12.7 }	A. 9.2 { 9.0 B. 10.0 }	A. 8.0 { 8.5 B. 9.0 }	A. 10.7 { 11.45 B. 12.2 }	A. 13.7 { 14.5 B. 13.3 }	A. 13.5 { 12.55 B. 11.6 }	A. 12.1 { B. 5.7 }	6.85	15.1
3	Medium Grade Dust	A. 14.0 { 14.15 B. 14.3 }	A. 8.7 { 9.65 B. 10.6 }	A. 7.7 { 8.35 B. 9.0 }	A. 10.7 { 11.2 B. 11.7 }	A. 16.5 { 16.75 B. 17.0 }	A. 12.9 { 11.95 B. 11.0 }	A. 10.5 { B. 6.0 }	7.5	16.9
4	High Grade Dust	A. 14.7 { 14.2 B. 13.7 }	A. 8.7 { 9.5 B. 10.3 }	A. 10.2 { 9.7 B. 9.2 }	A. 10.7 { 11.2 B. 11.7 }	A. 19.0 { 17.7 B. 16.4 }	A. 13.5 { 13.2 B. 12.9 }	A. 11.3 { B. 6.3 }	7.0	16.4
5	Extracted Dust	A. 15.6 { 15.45 B. 15.3 }	A. 9.3 { 9.6 B. 9.9 }	A. 7.2 { 8.1 B. 9.0 }	A. 11.0 { 11.6 B. 12.2 }	A. 17.6 { 17.05 B. 16.5 }	A. 13.4 { 13.15 B. 12.9 }	A. 16.5 { B. 6.5 }	7.3	14.5
6	Sulphate of Potash	A. 15.6 { 15.0 B. 14.4 }	A. 9.2 { 9.7 B. 10.2 }	A. 7.5 { 8.1 B. 8.7 }	A. 11.5 { 11.25 B. 11.0 }	A. 15.4 { 16.55 B. 17.7 }	A. 12.2 { 12.15 B. 12.1 }	A. 9.9 { B. 6.0 }	8.15	14.3
7	Medium Grade Dust (Interm. appln.)	A. 15.3 { 14.65 B. 14.0 }	A. 9.0 { 9.0* B. 9.0 }	A. 8.5 { 7.6 B. 6.7 }	A. 9.5 { 10.5 B. 11.5 }	A. — B. —	A. 12.4 { 12.4* B. 12.4 }	A. 10.9 { B. 6.2 }	—	16.2†
8	Medium Grade Dust (Late appln.)	A. 14.7 { 14.65 B. 14.6 }	A. 8.7 { 8.8* B. 8.9 }	A. 8.5 { 8.0 B. 7.5 }	A. 11.2 { 11.1 B. 11.0 }	A. — B. —	A. 11.9 { 12.25† B. 12.6 }	A. 11.1 { B. 5.8 }	—	17.3†
Quantity of Dung applied ..		10 tons per acre	10 tons per acre	—	—	—	9 tons per acre	—	—	12 tons per acre.

* Applied three weeks later than on other plots.

† Applied at the same time as the manures on Plots 2—6. These plots are, therefore, identical with Plot 3.

TABLE II.
Potatoes.
Relative Yields as compared with Control Plots = 100.

No. of Plot.	Potash Manure Applied.	Shropshire.	Worcester (Lincombe).	Devon (Woodwater).	Devon (Bridford Barton).	Suffolk (Eye).	Yorkshire.	Average of Series with Duplicate Plots.	Monmouth.	Suffolk (Nocton).	Cambridge.	Average of all Series.
1	Control	100	100	100	100	100	100	100	100	100	100	100
2	Low Grade Dust ..	93.4	103.8	133.9	105.5	97.3	106.8	107	126	100.7	97.4	107
3	Medium Grade Dust	104.4	104.2	131.5	103.2	112.4	101.7	109.6	109.4	110.3	109	109.5
4	High Grade Dust	104.8	102.7	152.8	103.2	118.8	112.3	115.5	117.7	102.9	105.8	113.5
5	Extracted Dust ..	114.0	103.8	127.6	106.9	114.4	111.9	113	171.9	107.4	93.5	117
6	Sulphate of Potash	110.7	104.9	127.6	103.7	111.1	103.4	110	103.1	119.9	95.5	109
7	Medium Grade Dust (Interm. appln.)	108.1	97.3	119.7	96.8	—	Included in Plot 3.	106.5	113.5	—	Included in Plot 3.	107
8	Medium Grade Dust (Late appln.) ..	108.1	95.1	126.0	102.3	—			115.6	—		

TABLE III.

*Mangolds.**Yield in Tons per Acre.*

No. of Plot.	Potash Manure Applied.	Warwick.	Shropshire.	Worcester (Hartlebury).	Cambridge.
1	Control	A. 26.3 B. 31.1	A. 27.2 B. 25.7	A. 10.1 B. 14.4	23.85
2	Low Grade Dust ..	A. 32.0 B. 31.0	A. 27.2 B. 24.2	A. 16.6 B. 18.1	19.9
3	Medium Grade Dust	A. 31.6 B. 32.3	A. 26.2 B. 27.5	A. 13.4 B. 15.1	23.1
4	High Grade Dust ..	A. 31.7 B. 32.4	A. 27.2 B. 27.5	A. 17.4 B. 17.2	22.6
5	Extracted Dust ..	A. 33.2 B. 32.3	A. 28.7 B. 28.2	A. 11.5 B. 13.4	30.0
6	Sulphate of Potash ..	A. 34.3 B. 30.3	A. 27.5 B. 27.0	A. 14.5 B. 14.8	35.0
7	Medium Grade Dust (Interm. appln.).	A. 31.3 B. 31.2	A. 29.7 B. 30.5	A. 12.0 B. 16.7	32.2†
8	Medium Grade Dust (Late appln.)	A. 31.6 B. 31.5	A. 27.5 B. 24.7	A. 17.4 B. 14.5	28.9†
Quantity of dung applied ..		—	10 tons per acre	10 tons per acre	—

* Applied five days later than on other plots.

† Applied at same time as the manures on Plots 2 to 6. These plots are therefore identical with Plot 3.

TABLE IV.

*Mangolds.**Relative Yields as Compared with Control Plots = 100.*

No. of Plot.	Potash Manure Applied.	Warwick.	Shropshire	Worcester (Hartlebury).	Average of Series with Duplicate Plots.	Cambridge.	Average of all Series.
1	Control	100	100	100	100	100	100
2	Low Grade Dust ..	109.8	97.2	141.6	116	83.4	108
3	Medium Grade Dust	111.3	101.5	116.3	109.5	96.9	106.5
4	High Grade Dust ..	111.3	103.4	141.2	118.5	95.6	112
5	Extracted Dust ..	114.1	107.6	101.6	107.8	125.8	112
6	Sulphate of Potash	112.5	103	119.6	111.5	146.7	120.5
7	Medium Grade Dust (Interm. appln.)	108.9	113.8	117.1	113.5	Included in Plot 3.	113.5
8	Medium Grade Dust (Late appln.) ..	109.9	98.7	130.2	118		

later applications of the Medium Grade Dust were made, have given average figures slightly lower than Plot 3, where the dust was applied earlier.

Even if one eliminates all results showing an increase under 10 per cent., the order of merit is not materially affected. This is shown in the following table :—

TABLE V.

<i>Manure.</i>	<i>No. of Centres showing an Increase of more than 10 per cent. over Control Plot.</i>				
Low Grade Dust	2
Medium Grade Dust	3
High Grade Dust	4
Extracted Dust	5
Sulphate of Potash	4

It is remarkable that the extracted dust, *i.e.*, dust very rich in potash, from which the bulk of the water-soluble potash salts has been removed by boiling water, should have given such good results. No adequate reason is at present forthcoming which would explain the apparent superiority of this type of dust, and further research is undoubtedly necessary before definite conclusions can be arrived at.

The results given by Plots 7 and 8 seem to indicate that it is necessary to apply the dust well in advance of the crop. This is probably due to the fact that a considerable proportion of the potash estimated by the official method is not immediately available.

Mangolds.—The results obtained on the mangold plots do not follow those shown by the potatoes.

It is unfortunate that three centres should have given no response to potash, since *only three duplicate plots and one with single plots can be included in the averages* (see Table IV.). As a consequence a high figure at one centre—*e.g.*, Plots 2 and 4 at Worcester, and Plot 6 at Cambridge—exercises an undue influence on the average figure for that particular plot, and renders it unreliable.

To obtain a better aspect of these results it appears desirable to take the number of centres showing increased yields of over 10¹/₂ per cent.

TABLE VI.

<i>Manure.</i>	<i>No. of Centres showing an Increase of more than 10 per cent. over Control Plot.</i>				
Low Grade Dust	1
Medium Grade Dust	2
High Grade Dust	2
Extracted Dust	2
Sulphate of Potash	3
Medium Grade Dust (intermediate appln.)					2
Medium Grade (late appln.)	1

The Low Grade Dust and late application of the Medium Grade Dust have evidently given the worst results. There is little to choose between the remainder.

APPENDIX.
Centres showing Negative Results.
Yield in Tons per Acre.

No. of Plot.	Potash Manure Applied.	Potatoes.				Mangolds.			
		Notts.	Edinburgh.	Herts. (Rothamsted).	Essex.	Herts. (Rothamsted).	Essex.	Notts.	
1	Control	A. 11.6 { 12.45 B. 13.5	A. 12.0 { 11.75 B. 11.5	A. 8.8 { 8.8 B. —	A. 13.2 { 12.95 B. 12.7	A. 19.3 { 18.6 B. 17.9	A. 26.0 { 27.35 B. 28.7	A. 39.2 { 38.45 B. 37.7	
2	Low Grade Dust	A. 10.9 { 12.2 B. 13.5	A. — B. —	A. — B. —	A. 12.6 { 13.05 B. 13.5	A. 14.2 { 14.2 B. —	A. 25.4 { 25.75 B. 25.1	A. 35.4 { 36.8 B. 38.2	
3	Medium Grade Dust	A. 9.8 { 11.5 B. 13.2	A. — B. —	A. 8.4 { 8.4 B. —	A. 14.1 { 12.3 B. 10.5	A. 11.9 { 11.9 B. —	A. 24.5 { 25.5 B. 26.5	A. 36.3 { 37.2 B. 38.1	
4	High Grade Dust	A. 10.7 { 12.2 B. 13.5	A. 11.2 { 12.1 B. 13.0	A. 8.1 { 8.1 B. —	A. 12.1 { 12.55 B. 13.0	A. 15.5 { 15.5 B. —	A. 26.2 { 26.35 B. 26.5	A. 36.6 { 36.15 B. 35.7	
5	Extracted Dust	A. 10.6 { 12.4 B. 14.2	A. 12.0 { 11.5 B. 11.0	A. 8.3 { 8.3 B. —	A. 11.7 { 12.25 B. 12.8	A. 19.9 { 19.9 B. —	A. 25.5 { 26.0 B. 26.5	A. 33.4 { 32.75 B. 32.1	
6	Sulphate of Potash	A. 10.9 { 12.9 B. 14.9	A. 12.0 { 11.75 B. 11.5	A. 8.4 { 8.4 B. —	A. 13.1 { 13.65 B. 14.2	A. 18.6 { 18.6 B. —	A. 27.8 { 26.75 B. 25.7	A. 34.9 { 33.75 B. 32.6	
7	Medium Grade Dust (Interm. appln.)	A. 9.6 { 11.35 B. 13.1	A. — B. —	A. 8.4 { 8.4 B. —	A. 10.9 { 13.7 B. 16.5	A. 15.5 { 15.5 B. —	A. 26.8 { 26.75 B. 25.7	A. 34.7 { 32.15 B. 29.6	
8	Medium Grade Dust (Late appln.)	A. 10.0 { 11.0 B. 12.0	A. — B. —	A. 9.0 { 9.0 B. —	A. 13.6 { 14.05 B. 14.5	A. 17.3 { 17.3 B. —	A. 25.9 { 24.95 B. 24.0	A. 36.2 { 35.85 B. 35.5	

Summary.—From the results of these trials it is apparent that Blast Furnace Dust, under suitable circumstances, gives notable increases in yields of potatoes and mangolds.

Further experiments are desirable to ascertain the precise nature of the active constituents.

RASPBERRY GROWING ON SMALL HOLDINGS.

J. M. HODGE.

1. ESSENDY SMALL HOLDINGS.

SOME 15 or 16 years ago, when the question of establishing small holdings throughout Scotland was being widely discussed, two or three business men determined to make a practical experiment with fruit-growing. The aim was to prove, if possible, that by following prudent business methods—not indulging in philanthropic schemes—fruit farming could be made moderately profitable to the small grower who either had no capital or very little, but was able and willing to put into his holding the labour necessary for success. Raspberries were selected as a promising crop and the district chosen was near Blairgowrie, a small town in eastern Perthshire and the terminus of a short branch line of the main Caledonian Railway between Aberdeen and Perth.

To carry through the experiment a small private company, the Blair Estates Company, was formed, with a share capital of £12,000 divided into 1,200 shares of £10 each, £5 of which was to be paid up. The shares were taken up by the Directors and a few friends interested in the movement. Towards the end of 1902 the Company purchased for £7,000 the estate of Drumellie and Essendy, extending to 450 acres, some 3 or 4 miles from Blairgowrie. At first local opinion was inclined to be somewhat critical of the undertaking, as the estate was outside the raspberry-growing district and the soil was cold. Fortunately, the results since obtained show that this view was wrong.

Two hundred and one acres of the poorest and most unsuitable soil from a fruit-growing point of view were soon disposed of to a neighbouring landowner for £4,475. Most of the remaining land was divided into small holdings and sold at £50 per acre. As the land was primarily intended for working men, it was arranged that a nominal cash payment should be made by the purchasers at the date of entry and the balance paid by 10 yearly instalments, interest at 4 per cent. being charged on the unpaid capital. This worked out roughly at about £6 per acre per year for 10 years. At the end of that time the land would belong absolutely to the purchaser, not bad terms in a district where fruit land was rented as high as £10 per acre. Before the year was out 156 acres in all had been sold for £7,768, in holdings ranging from 5 to 25 acres, to all sorts and conditions of people—an engineer, a joiner, a baker, a clothier, a plumber, a lawyer and a clergyman.

At the date of entry, Martinmas, 1903, therefore, the Company had sold 201 acres for £4,475, 156 acres to small holders for £7,768, and had in hand 93 acres, a highly satisfactory beginning in view of the fact that the estate had been purchased for £7,000.

Conditions of Success.—Three conditions were necessary if the colony was to be a success :—

1. *Access to Capital.*—Even though the purchase price was paid by instalments, it was found that access to capital was a necessity in the case of most of the small holders. A number of them were handicapped for want of capital from the beginning and had to be helped. The disastrous years 1909-10, when raspberries averaged a lower price than they had ever done before, would have meant ruin for some of the colonists if the Company had not come to their assistance by postponing the payment of instalments and advancing money to work the holdings. In thus playing the part of a land and credit bank the Company saved the situation without running any serious risk of loss themselves, for it was reasonably certain that the small holders would succeed if they got sufficient money to tide them over the bad years. They did succeed, and paid every penny of principal and interest.

2. *Expert Advice in Connection with the Laying Down and Working of the Holdings.*—In the light of subsequent experience much of the advice given to the growers at the outset could hardly be called expert, but the Directors did the best they could. They kept horses and men and did a good deal of the

horse-work in connection with the preparing and planting of the ground at the same figures at which it would have been done in Blairgowrie. They also planted for the owners a number of the holdings and worked them for some years, thus enabling those growers new to the work and with small capital to continue their work elsewhere until their holdings were in full bearing.

3. *Co-operation among the Small Holders.*—In the early days of the industry in the Blairgowrie district there was no housing question, as the fruit was picked by the villagers. Later on, when the industry developed, the pickers came from farther afield and some attempt had to be made to provide them with accommodation. At first this was left to individual enterprise, and the fields became dotted with more or less respectable sheds for the housing of the pickers. This was the state of affairs when the housing problem at Essendy had to be faced in 1905. A somewhat ambitious housing scheme on co-operative lines was then carried into effect. The housing plan decided upon at the outset was adhered to until the holdings were in full bearing and buildings adequate to the needs of the industry had been erected. The progress of the building operations and the cost may be gathered from the following figures, showing the expenditure incurred year by year :—

				£
1905	..	..	..	733
1906	..	..	..	1,927
1907	..	..	..	731
1908	..	..	..	50
Total .. , ..				<u>£3,441</u>

When completed, the buildings, which were erected on a moor on the west side of the holdings, consisted of three spacious dining rooms, capable of seating 1,000 pickers. One of the rooms was turned in the evening into a writing room, and another, provided with a piano, into a recreation room, while there were also two kitchens, fitted up with all the usual and necessary cooking utensils, and 48 dormitories, capable of holding 20 pickers each, and fitted with iron beds and such bedding as would be found in a working man's house. Adjoining were drying sheds and lavatories, and to render it unnecessary for the pickers to make pilgrimages to Blairgowrie a grocer's shop, a stationer's shop, and a post office were erected. Concerts were held on week nights and religious



FIG. 1.—Essendy Small Holdings.



FIG. 2.—Pickers' Houses at Shinaloot, Auchterarder.



FIG. 3.—Beginning of the Industry at Essendy.



FIG. 4.—Picking Raspberries.

services on Sunday. A matron and 30 servants under the control of a superintendent were engaged to cook and serve the food, and attend to the comfort of the workers. The services of a doctor were retained for the benefit of the pickers.

It may also be mentioned that each grower had an interest in the buildings in proportion to the acreage of ground he owned. The pickers were secured not for the individual but for the associated growers, and allocated among them according to their needs. The produce of the colony was sold by a salesman appointed by the colony for the purpose. Altogether the scheme was a decidedly novel one and, so far as the writer is aware, it has no counterpart in the United Kingdom or elsewhere.

Results of the Experiment.—The 10 years allotted to the experiment ended so far as most of the holdings were concerned in 1913. That is, therefore, the most convenient date from which to look back and measure its success or failure.

The small holdings at Essendy, including 40 acres held by the Blair Estates Company, never exceeded on an average 207 acres. This land was rented at the time the Estate was purchased at less than £1 per acre. The gross return obtained from the cultivation of raspberries for the 10 years of the experiment (there was no return in 1904) has been, as the following figures will show, £89,159 7s. 2d. :—

Year.	Acreage.	Tonnage.			Price per Ton.			Gross Return.		
		T.	cwt.	qr. lb.	£	s.	d.	£	s.	d.
1905 ..	189½	89	6	1 16	21	0	0	1,875	14	3
1906 ..	189	380	14	0 16	23	9	2	8,930	15	1
1907 ..	187½	449	4	3 23	20	11	8	9,247	0	0
1908 ..	218	527	6	1 14	16	16	8	8,876	10	8
1909 ..	217½	736	2	1 24	11	16	3	8,695	9	1
1910 ..	217½	688	17	3 24	15	16	3	10,893	4	1
1911 ..	217½	571	15	2 1	28	16	8	16,486	3	10
1912 ..	217½	436	6	1 24	29	0	0	12,653	7	6
1913 ..	215½	357	15	2 11	32	2	11	11,501	2	8

£89,159 7 2

Labour.—Needless to say, much of this money did not find its way into the pockets of the growers. The yearly labour bill, excluding picking, would after the first three years amount to £7 per acre. The cost of picking depends upon the size of the crop and the cost of labour. The wages which at the

beginning of the experiment were at the rate of $\frac{1}{4}$ d. per lb. of fruit picked, rose year by year, until it sometimes became a question whether the price of the fruit would cover the cost of picking. In no year would it be safe to put the picking expenses at less than £6 to £7 per ton. These sums in the 10 years would amount to over £40,000.

Carriage.—So far as it is possible to estimate, the sum paid to the Railway Company during the 10 years for carriage amounted to from £7,000 to £8,000. At first the service provided by the Company was bad and it was very difficult to obtain concessions from them, but ultimately they realised the importance of the industry from a railway point of view, and put at the disposal of the growers a really good service.

Taxes.—The small holders had a distinct grievance against the taxing authorities. No sooner were the small holdings in bearing than the Assessor increased the annual valuation from £1 to £3 per acre, with the result that while the whole estate—450 acres in extent—paid in 1902, as agricultural land, £21 11s. yearly in rates, the fruit holdings, extending to something under 220 acres, paid £75.

Financial Results of Experiment. Judged by the profit obtained by the individual small holder, how has the Essendy scheme fared? It is impossible to arrive at the profit of each individual holding, for fruit-growers, like farmers, do not keep books. Some general idea may be obtained, however, by taking an average holding as the standard by which to judge the whole. The holding taken extends to 15 acres, was worked with hired labour, and everything that was done was paid for. The crops over the whole term of the experiment were slightly under the average of the whole crops. In submitting the figures applicable to this holding, it should be explained that the credit or debit each year is arrived at by taking the total payments, capital and revenue, and the total income, and deducting the one from the other. The yearly figures thus arrived at do not give a true account of the year's working. For example, only one instalment of the price of the holding was paid till 1911, an indication, by the way, of the consideration which the Company had for the small holders, while in 1911, which was a good year, seven instalments were paid. Sometimes, too, accounts were not paid when they were incurred, and the labour bill for one year was charged to another year. The total figures, however, give a correct account of the

financial results of the experiment over all the years. They are as follows :—

Year.	Tonnage.			Tonnage per Acre.			Instal- ments paid.	Excess of Debits over Credits.			Excess of Credits over Debits.		
								£	s.	d.	£	s.	d.
1904	—			—			—	140	0	5	—		
1905	171	3	7	11	2	16	—	33	14	10	—		
1906	710	2	8	48	0	19	—	113	4	6	—		
1907	714	0	7	48	1	17	—	—			122	0	0
1908	729	2	16	49	1	24	75	—			146	11	2
1909	907	2	16	69	3	25	—	—			105	15	11
1910	768	0	20	59	0	10	—	—			178	16	2
1911	734	3	23	50	2	20	525	—			38	7	7
1912	554	0	2	36	2	20	75	—			390	13	10
1913	477	0	5	31	3	6	75	—			439	13	11
								£286	19	9	£1,421	18	7
Profit, 1904-13								..	..	..	£1,134	18	10

During the ten years of the experiment, this grower paid out of his holding all the working expenses, including management fees and interest on capital. He also paid out of his holding the price of it, viz., £750, and saved £1,134 18s. 10d., making a total of £1,884 18s. 10d., which represents £188 9s. 10d. every year of the ten years 1904-13. His holding was then carried on by his representatives till May, 1916. The figures for this latter period are as follows :—

Year.	Tonnage.			Tonnage per Acre.			Excess of Debits over Credits.			Excess of Credits over Debits.		
	Cwt.	qr.	lb.	Cwt.	qr.	lb.	£	s.	d.	£	s.	d.
1914 ..	604	0	19	40	1	3	—			132	16	8
1915 ..	475	2	8	38	0	13	—			159	13	0
Expenses incurred from January to May, 1916							11	11	0	—		
										£292	9	8
										11	11	0
Profit, 1914-15 .. .. .							..	..	..	£280	18	8

The net profit from this holding has, therefore, been :—

1. The price at which it was sold in 1916	..	£1,000	0	0
2. The net income to that date	..	1,415	17	6
Total	..	£2,415	17	6

representing £201 6s. 5d., every year from 1903 when the holding was planted till the close of the fruit season of 1915.

Some of the other holdings at Essendy did better than this holding, while some did not do so well. That was, of course, natural, for the one just quoted was an average holding. While the profit on this holding must not necessarily be taken as the profit on any other similar-sized holding on the estate, the profit per acre on this holding arrived at after deducting all the working expenses, management fees, and interest on capital, may be taken as the average profit per acre on the aggregate of all the holdings, comprising in all 207 acres. This shows for the 10 years of the experiment a total profit of £26,012. Assuming that the holdings which are still in existence were worth in 1916 as much per acre as this holding, then the total profit for the 12 years to that date on the 207 acres would be £33,339.

This result, taken along with the profit made by the Company, justifies the experiment, and suggests to business enterprise some new lines of national development.

2. DRUMTOGLE SMALL HOLDINGS.

The farm of Drumtogle, comprising 220 acres of the Estate of Aberuthven in the parish of Auchterarder, was offered for sale in the summer of 1907. It was purchased by a Blairgowrie merchant, with the view of establishing a colony of small holders on the Essendy basis. The purchaser supplied the capital and it was agreed that the writer should arrange the working of the scheme.

It was at first considered doubtful whether the cultivation of raspberries on the colony would prove a sound economic proposition. It was known that raspberries would grow in the district, but it had still to be shown whether they would grow well enough on a large scale to ensure the success of the holdings. The two main factors against raspberry cultivation in the district were wind and frost. It was feared that the unsheltered nature of the district would have a harmful effect on the bushes, while the cold mountain air which settled in the valley in which Drumtogle was situated would be an even more serious drawback. It was felt, however, that the wind might sweep the cold air out of the valley, thus creating a circulation of air which would prevent a fall in temperature, and it was finally decided to go on with the venture.

Near the farm is situated the village of Aberuthven, a small hamlet containing a few people, mostly engaged in agriculture. The creation of small holdings for fruit

culture promised an excellent opportunity for the development of the village. A meeting of the local workers was called, and it was explained that the Drumtogle land was to be sold as the Essendy land had been sold, at £50 per acre, the price to be payable in 10 yearly instalments, with interest at 4 per cent. on the unpaid balances. The villagers, however, showed no desire to fall in with the scheme, and the proposal was therefore laid before others, with the result that within a few months the farm, with the exception of about 10 acres, had been disposed of. One half went to Blairgowrie fruit-growers, while a silk mercer from London, a coal merchant from Dundee, a fruit-grower from Clydeside, a draper, a carter and a ploughman also shared in the scheme.

The farm of Shinafoot, extending to 82 acres, also part of the Estate of Aberuthven, was bought on the same day as Drumtogle. This farm was not purchased for the purpose of dividing it into small holdings. The Essendy scheme, although then in its infancy, was apparently to prove that small holdings for fruit culture would pay both the company which created and financed them, and also the small holders who bought them, and it was hoped that the Drumtogle scheme, just started, would confirm the Essendy results. In any case there did not seem to be at the moment any further call on those who had been creating small holdings, to do more than they had already done. A new departure was, therefore, made in the formation of a Joint Stock Company known as the Shinafoot Estate Company, to grow raspberries in the Auchterarder district. The other farms on the Aberuthven Estate were sold in 1912. The Blair Estates Company, which created the Essendy holdings, purchased one of them extending to 160 odd acres. They planted fully 100 acres with raspberry bushes and are working 60 acres as agricultural land, with the view of testing how far such a farm is economically a sound business proposition. The Arns Company, in the same year, acquired another of the farms, extending to 100 acres, and forthwith turned it into a raspberry plantation. The Westerton Company bought the remaining farm of about 120 acres. It was held by a sitting tenant under a lease and possession was not obtained till 1915. The land is now, as in the case of all the other farms, being entirely devoted to the production of raspberries.

It was not difficult thus to change an agricultural district to a fruit district. Some difficulty was experienced, however, in bringing into existence and maintaining the organisation

that was necessary to work the new industry. At the outset the problem of permanent labour had to be faced, and this was more difficult to solve than at Essendy. Essendy was within easy distance of Blairgowrie, where permanent workers were numerous enough to meet the demands of the Essendy growers. When fruit-growing began at Auchterarder there was no skilled labour, for practically no fruit had been grown in the district, and the labour had to be imported for several years from Blairgowrie. Blairgowrie in the end was found to be inadequate, however, and the services of every labourer who offered himself had to be accepted. Needless to say, such labour was neither the most economic nor the most efficient, though it was the best possible. It was the casual labour during the harvest, however, that caused most trouble. The industry was only just getting under way when the problem of the housing of the pickers had to be faced, for the Auchterarder holdings, like those at Essendy, were far removed from the busy centres of population. It was found at Essendy that it was a disadvantage to have all the buildings together, mainly because some of the workers were thus a long way from their work. A further disadvantage in the case of Auchterarder was that enough pickers of one sex or one class could not be obtained, and it was, therefore, necessary to arrange the housing so as to be able to accommodate all classes and both sexes—men and women, factory workers and teachers, inmates of the slums and “gentlemen of the road,” newsboys from the street and children from the school—without one class or sex coming in contact with another class or sex. With this object in view the companies which worked the larger fruit farms at Auchterarder erected two sets of buildings on each of three farms, and one set of buildings on the fourth. The buildings consisted of a dining-hall, capable of seating 300 workers, kitchens more modern than anything hitherto erected, and dormitories of varying size, fitted with wooden beds and provided with bedding suitable for a camp life in the fields in summer time.

The social life of the community thus provided for was planned in detail. The settlements were put under the charge of one or more superintendents, the number being determined by the different classes of pickers employed. They were responsible for the comfort of the pickers, and arranged for entertainments of various kinds—concerts, fancy dress balls, picnics, etc., according to the talent and the inclination of the workers. A resident medical officer was available in cases of sickness,

while a cleansing officer kept the camp clean and a number of policemen kept it in order.

Before considering the cost of starting and working the Auchterarder holdings, it may be convenient to group the farms in the order in which they were planted with raspberries, so that it may be seen at a glance the acreage involved.

	<i>Acres.</i>
Drumtogle small holdings, created and planted in 1907	196
Shinafoot, planted in 1907	76
Hall of Aberuthven, planted in 1913	105
Arns, planted in 1913	96
Pendicles, planted in 1913	25
Westerton, planted in 1915 and 1916	120
	<hr/>
	618

The figures of the cost of creating and working the plantations into full bearing here given are, of course, pre-war figures, for the plantations were mostly laid down before the War. In any case it would be inadvisable to give war figures, for they were so abnormal that no conclusion could be drawn from them. For example, posts which cost 5*d.* each before the War, cost from 1*s.* to 1*s.* 6*d.* each during the War; wire which cost 12*s.* per cwt. before the War, cost 44*s.* per cwt. during the War; and barrels which cost 5*s.* before the War, cost from 10*s.* to 15*s.* during the War. Moreover, the figures are somewhat rough, under rather than over the actual cost, but sufficient to give some idea of the amount of money involved in the Aberuthven scheme.

	<i>£</i>
Price of land	28,400
Cost of pickers' houses and furnishings	8,000
14,000 tons manure at 10 <i>s.</i> per ton delivered	7,000
4,326,000 raspberry canes at £1 per 1,000	4,326
123,600 posts at 5 <i>d.</i> each	2,575
139 tons wire at £12 per ton	1,668
12,360 barrels at 5 <i>s.</i> each	3,090
3,090 large pails at 10 <i>d.</i> each	128
3,090 small pails at 5 <i>d.</i> each	64
Steelyards, etc.	200
Labour	9,000
Rates, taxes, insurance, etc.	1,200
	<hr/>
	<u>£65,651</u>

It is impossible just yet to show how the whole of the fruit farms at Auchterarder have fared, because some have only recently reached the bearing stage, and one of them is only

approaching it. It can, however, be shown—and this from a national point of view is the more important thing—how the Drumtogle small holders have fared. The results are all the more important in view of the fact that a special plea has recently been put forward on economic grounds for industrialised farms, that is large farms, run on industrial lines. It is asserted that if we could only run a large farm as we run a business, dividing it into departments superintended by capable men and controlled by a head who was able to combine a knowledge of agriculture with business methods, there would be very considerable saving in large as opposed to small farming.

This may be so, but it is doubtful if the idea is a practical one. In a workshop, the intelligence of the worker is often a non-essential part of the work. His work is a mere mechanical operation in which brains are at a discount. In agriculture, however, it is different, for even as regards labour in a subordinate capacity the intelligence of the worker plays a large part in the success of the operation. Waiving the difference between the farm worker and the shop-hand, however, and taking the long view, the writer is not sure that increased production on industrialised lines would ultimately pay for the elimination of the small holder. The division of labour, the corner stone of every large concern, has a limit beyond which it is not wise to go—the limit being the point at which the division of labour affects the intelligence and the character of the worker, and makes him not only less a man but also a less efficient man from an economic point of view. Brains and character may in the long run in every department of human life be the determining factor in the production of goods as well as of men. It may, therefore, be better, even from an economic point of view, to produce less now, if thereby we can ultimately produce intelligent small holders rather than less intelligent day labourers. In any case, we should ever remember that the highest production, while it should never be lost sight of, is not necessarily the chief end of a nation, any more than of a man.

Theorising apart, the experience of the writer, in the management of thousands of acres in Canada where grain is grown and cattle are fed, of hundreds of acres in this country constituting probably the largest holding of the kind in existence where raspberries are grown, and also of a multitude of small holdings, has led him to the conclusion that the small holding is the more productive. It can be, and where the

farmer is the right kind of man and has money it usually is, better worked. This applies in raspberry-growing especially to two operations, the cutting out of the canes and the picking of the crop. Both can be done with much more care on a small than on a large farm. Take some examples. The Drumtogle small holdings at the outset varied in size from 2 to 40 acres. The average yearly crop per acre for the whole period, since they came into existence, has been 1 ton 11 cwt. 2 qr. 6 lb. Two of the holdings extend to two acres each. One of the two—it was considered at the time it was sold the worst on the estate—was worked and picked by the small holder himself, and produced on an average 2 tons 16 cwt. per acre. These are the figures :—

Year.	Average Return per Acre from all the Drumtogle Small Holdings.					Return per Acre from 2-acre Holding.				
	Tons cwt. qr. lb.					Tons cwt. qr. lb.				
1909 ..	0	9	3	2	..	0	15	2	0	
1910 ..	1	9	1	25	..	2	13	3	1	
1911 ..	1	4	2	19	..	2	8	1	4	
1912 ..	1	18	3	17	..	3	13	1	18	
1913 ..	2	3	2	4	..	3	13	0	14	
1914 ..	2	14	2	21	..	4	0	3	13	
1915 ..	1	18	3	4	..	2	11	0	25	
1916 ..	1	2	0	26	..	2	3	3	21	
1917 ..	1	3	1	1	..	2	15	1	21	
1918 ..	1	10	0	27	..	3	4	1	25	

The other 2-acre holding was worked and picked along with some of the larger holdings, and produced roughly the same amount. Subsequently it was worked and picked separately. These are the results :—

Year.	Average Return per Acre of all the Holdings.				Return per Acre of the 2-acre Holding when worked and picked along with other Holdings.				Return per Acre of the 2-acre Holding when worked and picked separately.			
	Tons cwt. qr. lb.				Tons cwt. qr. lb.				Tons cwt. qr. lb.			
1909 ..	0	9	3	2	0	7	1	8	—			
1910 ..	1	9	1	25	1	11	1	4	—			
1911 ..	1	4	2	19	1	13	3	2	—			
1912 ..	1	18	3	17	1	8	2	8	—			
1913 ..	2	3	2	4	2	0	0	16	—			
1914 ..	2	14	2	21	—				2	7	3	0
1915 ..	1	18	3	4	—				2	2	3	17
1916 ..	1	2	0	26	—				1	7	3	8
1917 ..	1	3	1	1	—				2	2	0	13
1918 ..	1	10	0	27	—				2	2	1	25

Similar results were obtained from the crops grown at the Hall of Aberuthven, extending to 105 acres, and two adjoining holdings of, respectively, $4\frac{1}{2}$ acres and $6\frac{1}{2}$ acres. These are the returns per acre for the last 4 years :—

Year.	Hall of Aberuthven.				$4\frac{1}{2}$ -acre Holding.				$6\frac{1}{2}$ -acre Holding.			
	Tons	cwt.	qr.	lb.	Tons	cwt.	qr.	lb.	Tons	cwt.	qr.	lb.
1915 ..	0	19	1	12	2	0	0	3	1	10	0	9
1916 ..	1	2	1	4	1	15	2	16	1	12	1	10
1917 ..	1	15	1	11	2	9	0	11	2	16	1	13
1918 ..	1	9	0	21	2	3	2	5	2	3	1	0

The last instalment of the purchase price was paid in 1917. It is interesting to examine the figures showing the returns from these holdings during the 11 years they have been in existence. The gross return from the cultivation of raspberries during the 11 years has been, as the following figures show, £82,847 :—

Year.	Acreage.	Tonnage.				Price			Gross		
		T.	c.	q.	lb.	£	s.	d.	£	s.	d.
1909 ..	196 $\frac{1}{2}$	96	0	2	10	7	17	11	758	4	7
1910 ..	196 $\frac{1}{2}$	289	10	2	17	13	4	7	3,830	5	6
1911 ..	189 $\frac{1}{2}$	233	15	1	24	29	0	5	6,784	5	9
1912 ..	189 $\frac{1}{2}$	368	13	0	19	29	4	2	10,767	18	0
1913 ..	196 $\frac{1}{2}$	412	11	0	8	32	2	11	13,261	17	6
1914 ..	196	536	0	3	5	29	6	8	15,723	16	7
1915 ..	196	380	3	0	14	23	0	0	8,743	11	10
1916 ..	196	217	19	0	0	22	10	0	4,903	17	6
1917 ..	196	227	19	3	19	37	5	0	8,492	17	0
1918 ..	140	211	14	3	0	45	5	0	9,581	2	4

£82,847 16 7

The bulk of this money was divided among various classes—the timber merchant for posts, the iron merchant for wire, the builder for housing, the dairyman for dung, the labourer for wages, the railway for freight, and the assessor for rates and taxes. The small holders got what was left. They were in some respects more fortunate than the Essendy holders. The bad years 1908–10, which struck Essendy when the holdings were at their best, struck Drumtogle before the holdings were in full bearing. Still the Drumtogle growers felt the pinch of these years and some of them, as, for example, those who had to finance Drumtogle out of the Essendy profit, had to be given financial assistance. In some respects, however, Drumtogle was less fortunate than Essendy. It was struck

by frost in 1911 as Essendy has never been, and 70 acres only produced 10 cwt. to the acre. That, however, has been the only occasion on which Drumtogle has suffered more than other places, and it was only the low-lying land on the estate that was affected, so that it may still be said to be comparatively free from frost. A few of the holdings have changed hands, and always at a substantial profit to the seller. One, of 9 acres, was sold in 1914 at a profit of £566, another, of 10 acres, in the same year at a profit of £988, and a third, of 15 acres, 8 acres of which were in fruit, was sold in 1915 at a profit of £700. The profit to the buyers may not always have been so good, but the original purchasers have, on the whole, done well.

As an example of the success of the holdings a typical holding is selected. This holding, comprising 30 acres, is in every respect most suitable as a test by which to judge of the success of the holdings generally. The crops grown on this holding have been rather under the average crops at Drumtogle, so that in taking this holding as typical the success of the scheme is not exaggerated. Further, this holder neither financed nor managed nor worked his holding. Every penny expended in management and labour was duly charged for and entered against him. His account was kept in the same way as the account of the Essendy holding before referred to. There is thus no difficulty in arriving at the *ex*ot income and expenditure, without which his holding

Year.	Tonnage.				Tonnage per Acre.				Instal- ment.	of			Excess of					
										Debits over Credits.			Credits over Debits.					
	T.	c.	q.	lb.	T.	c.	q.		£	£	s.	d.	£	s.	d.			
1908 ..	—								—	468	15	2	—					
1909 ..	17	17	3	7		11	3	20	—	388	15	3	—					
1910 ..	45	8	1	1		1	10	1	3	—	—			84	9	0		
1911 ..	22	17	3	9		0	15	0	10	—	792	2	11	—				
1912 ..	58	7	3	26		1	18	3	20	750	69	13	8	—				
1913 ..	61	10	3	18		2	1	0	3	150	—			1,007	14	2		
1914 ..	88	19	2	9		2	19	1	8	150	—			1,275	16	10		
1915 ..	52	0	3	2		1	14	2	21	150	—			189	11	9		
1916 ..	Expenses incurred in connection with the working of the holding from January to May, 1916									65	0	7	—			
											£1,784			7	7	£2557	11	9
Net Income											—			£773			4	2

The net profit on this 30-acre holding was, therefore :—

	£	s.	d.
1. Instalments of price paid	1,200	0	0
2. Net Income, as above	773	4	2
Total	£1,973	4	2
which shows after paying expenses of all kinds a yearly income of £246 13s. 0d for the eight years from 1907, when it was planted, till the end of the fruit season of 1915. This holding, however, was sold in 1916, with entry at May of that year for	£2,200	0	0
Less the balance of the instalments then due, which the purchasers bound themselves to pay	300	0	0
	£1,900	0	0
Add to this the net income shown above	773	4	2
And the total net profit from the time it was planted in 1907 till it was sold in 1916, including the profit made on the sale, works out at	£2,673	4	2

representing an income every year from the first year to the last year of £334 3s.

be accepted as the standard by which to judge the others. The net income after payment of working expenses and management fees and interest on capital from 1907, when the holding was purchased, to 1916, was £773 4s., made up as shown on p. 409.

This being a holding producing a little less than the average acre on the profit per acre on it may be taken as the profit per acres. This aggregate of all the holdings, extending to 194 £12,760. If the value of all the holdings be taken instead of the price paid for them, if they were worth per acre what this holding was sold for in 1916, then the total profit to that date would be £17,286.

The success of the holdings, both at Dr. L. L. L. and Essendy, has fully justified the experiment, everybody connected with the enterprise having profited financially—the men who created them, the small holders who worked them, and the community which gave its labour and its goods in exchange for their produce. The experiment affords a striking example of what can be achieved by a well-organised scheme of fruit-growing on co-operative lines, given sufficient financial support to assist the holders over the lean years.

CHEESE-MAKING: THE MANUFACTURE OF CAERPHILLY AND CHEDDAR CHEESE.

USE OF STARTER.

Reason for Use.—The market value of the produce of the cheese maker is of the greatest importance to him, and the market demands a cheese of good uniform quality. This quality is controlled to a great extent by the correct production of acidity in the milk and curd during the process of manufacture.

The ripening or souring of the milk may be brought about in two ways, either by allowing it to sour naturally, or by adding a pure culture starter. This starter consists of milk in which are growing lactic acid bacteria or organisms in as near a pure state as is possible.

These organisms are found in the atmosphere or in naturally soured milk, but when grown in a purer form they are more vigorous and are able to overcome any injurious organism that may be present in the milk to which they are added, and in this way ensure, to a great extent, a good flavour in the cheese.

Milk is soon affected by weather conditions and outside contamination—even the cleanest milk will become sour when kept at a high temperature; milk contains organisms as soon as produced, which increase rapidly at a favourable temperature (*i.e.*, 70°–90° F.). Should the milk contain particles of manure, dust, etc., it will rapidly deteriorate, and the souring that then takes place will result in inferior cheese, which will puff and leak in the ripening room. In order to control the acidity in the milk, therefore, it should be cooled down as soon as possible to 70° F., either by running it over a refrigerator, or by placing it in a jacketed tub or vat surrounded by cold water, constantly stirring it meanwhile. This gets rid of any “cowy” odour and prevents the cream from rising.

Preparation of the Starters.—The starters are prepared in the first place by experts, and may be obtained from the various dairy schools and colleges in bottles ready for use in the dairy. The British Dairy Institute, Reading; the Midland Dairy College, Kingston, Derby; the Dairy School, Kilmarnock; the East Anglian Institute of Agriculture, Chelmsford, etc., all supply starters ready for use.

Having obtained a bottle of the starter, a sufficient quantity should be prepared for the next day's use. This must be done each day. The amount will vary according to the quantity of

cheese being made, the bulk of milk, the time of year, and the district (different localities require more or less starter to produce the correct acidity). Usually 1 to 2 qt. per 100 gal. may be used. A well-enamelled jug or milk-can should be procured; the latter is most convenient as it can easily be suspended in a copper or furnace, and, being usually fitted with a lid, will prevent contamination of the milk while it is being heated. The vessel should be thoroughly scalded, after which some well-strained milk that is sweet, fresh and free from all objectionable tastes and odours should be measured in. The vessel should be placed in hot water and the temperature quickly raised to 185° F. It should then be left 10 minutes and finally cooled rapidly to 65° F. in summer, and 75° F. in winter. The starter should then be added from the bottle and mixed well with the milk, which should afterwards be covered with clean double muslin and kept at an even temperature until next day. In winter it must not be allowed to become cold, for this will check the growth of the organisms, and the starter will not be sufficiently sour next morning, but care must be taken that it is not kept too warm, or the organisms will use up all the available food in the milk. If the starter becomes a firm curd, granular in texture, the bacteria are not so active for cheese-making when put into the milk. Should they produce too much acidity, they eventually destroy themselves, hence the reason for making a fresh starter daily, and it is of no use to reserve any of the contents of the bottle first procured for further use.

When ready for use the starter should be curdled in an even mass, and if stirred it should have a smooth, creamy appearance; it should have a clean, acid taste and show 0·7°–0·8° per cent. of lactic acid on the acidimeter. Before adding the starter to the milk, about $\frac{1}{2}$ pt. should be reserved from which to make the starter for the next day; this will avoid the necessity for obtaining a further supply of the bought culture. If the starter shows signs of weakness, that is, if the cheese works slowly for several days consecutively, or if it develops inferior flavours or odours and is granular in appearance, a fresh culture should be obtained.

If care and cleanliness are observed during manufacture a culture will last several weeks, but it will rapidly deteriorate with careless management.

Method of Use.—The evening's milk having been well cooled, the next morning the cream should be skimmed off, heated to 90° F., put back into the tub and the temperature of the

whole raised above 70° F. The starter may then be strained into the milk, enough being added to produce a curd that will be ready for vatting 7 to 8 hours after adding the starter; the starter should be in the milk 1½-2 hours before renneting. It is found in practice much better and safer to add a small quantity of starter and leave it in the milk some time before renneting, rather than use a large amount and add the rennet soon after. The starter organisms being put into milk at a suitable temperature for their growth become acclimatised, and overcome or at least predominate over any injurious germs that may be present. The milk is evenly ripened and the production of acidity later is more regular, preventing fast cheeses and producing a mellow curd. A large quantity of starter added just previous to the rennet produces a quick, granular curd, which in the later stages works too rapidly for proper mellowing, and the resulting cheese is short and crumbly in texture, does not cut fat on the iron and is of inferior flavour.

THE MAKING OF CAERPHILLY CHEESE.

Caerphilly cheese is consumed in large quantities in the mining districts of the south-west of England and in Wales, where it is considered to be specially suited to the needs of the underground workers. Although Wales was its original home, its manufacture has now spread to other parts, and quite half the supply of Caerphilly cheese consumed in Wales is made outside its borders.

The most popular kind of Caerphilly is a cheese of the quick-ripening variety, available for consumption a fortnight to three weeks after manufacture. It is, therefore, of a perishable nature and deteriorates in quality after 4 to 6 weeks, becoming dry in texture.

This cheese is made from morning's and evening's milk, and as the curd retains a large percentage of moisture very little acidity is required. It is, therefore, a cheese that can be made throughout the year, even in cold weather.

To make the cheese without starter, the evening's milk, as soon as obtained, is strained into the cheese vat or tub, and well stirred to get rid of the "cowy" odour and to lower the temperature slightly. In cold weather it is necessary to keep the vat or tub covered to avoid loss of heat, so that a certain amount of acidity will develop to ripen the morning's milk when added. This prevents the cheese from working slowly, which would result in a hard, dry curd. In warm weather it is unnecessary to cover the night's milk. When starter is used

the night's milk must be cooled to below 70° F. as soon as obtained to check the production of acidity, and it should also be stirred occasionally during the evening to prevent the cream rising.

Next morning the cream should be skimmed off and mixed with warm new milk, which should be slowly heated to 90° F. by holding in hot water. It should be poured back through the strainer into the cheese vat and thoroughly mixed. The temperature of the milk should be raised above 70° F., after which the starter should be strained in. The amount will vary, but enough should be used to ensure that the milk is acid for renneting 1 to 1½ hours after adding, and the cheese ready for vating 2 to 2½ hours after renneting.

The morning's milk may be added at any time, and when all is in the vat the temperature should be raised to 88°–90° F. in summer and 90°–92° F. in winter. The test (by the acidmeter) for renneting should be 0.19–0.2 per cent. acidity; too much acidity must not be present or the cheese will be over-acid before it can be vatted.

The amount of rennet will depend on the quality and temperature of the milk and the strength of the rennet. Usually one dram to every 4 or 6 gal. of milk is required, but enough should be used to produce a curd that will break cleanly over an inserted finger about 45 minutes after renneting. The rennet should be mixed with 3 or 4 times its volume of water before being added to the milk. The curd should be cut into cubes the size of horse beans and stirred with the hand very gently for 15 to 20 minutes. When the curd is loose and the whey has well separated it should be allowed to settle to the bottom of the vat, and a test for acidity made. The acidity should not be more than 0.15–0.16 per cent. If under that figure the whey should be left for a further 20 to 30 minutes; if over, after allowing the curd to settle, push it gently back from the tap, cut off a convenient sized portion under the whey and float it back on to the mass. This gives a clear space by the tap, and the whey can then be run off. As soon as the whey has all drained away, a channel should be cut down the centre of the vat, the sides sloping away from the centre, and the curd piled in semi-cone shaped masses on either sides of the vat. This cutting and piling should be continued for 10 to 15 minutes, taking care that the curd is not broken when piling, and when it is sufficiently dry and forms a firm jelly-like mass, it may be covered and left for 10 to 15 minutes, according to the acidity. The curd should

now be cut into finger-like slices, which should be piled on their sides at the back end of the vat, in a semi-cone-shaped pile as before. The curd should be left until the drainings show 0.17-0.18 per cent. of acidity (the lower acidity in the case of a large quantity of quick-working curd), and it may then be vatted. This is done by slicing the curd into 1-in. slices and packing it into cloth-lined vats having removable bands. It is advisable to weigh a definite quantity of curd into the vats so that the resulting cheeses will be even in size. The cheeses may be placed one on top of the other while vating, and if then reversed and the cloths pulled up and placed smoothly before putting the cheeses to press it will be found that they are partially pressed and, therefore, easier to place in the press. Pressure should be applied gradually, the bar (without weights) being lifted at the end of one hour. The cheeses may now be turned, and well rubbed with salt, the cloths being rinsed in cold water before being used again. The cheeses should be put to press with the bar pressure only, and left until next morning, when they can be taken from the moulds and put into brine for 24 hours. The brine is made from boiled water (which has become cold) and sufficient salt to float an egg. The surface of the cheeses when in the brine should be sprinkled with salt to prevent the coat from drying; they should be turned over the same evening and again sprinkled with salt. This keeps up the strength and takes the place of the salt extracted by the cheese, preventing drying of the top surface. The brine should be entirely renewed as soon as it becomes at all cloudy in appearance, or it will have a deteriorating effect on the coats of the cheese.

When taken from the brine the cheese should be allowed to drain in the dairy for 24 hours, and then removed to the ripening room. This room must be cool and airy, so arranged that there is no direct draught on the cheese. Ample shelf space should be provided, so that the cheese can be turned daily on to a dry space. This ensures the formation of a good coat, which is very necessary before the cheese can be put on the market. The time of marketing depends generally on the weather; in a dry, fresh atmosphere the cheese will coat and be ready for market in 7 to 10 days, but in damp, close and sultry weather the rind becomes sticky and requires a longer period to dry off.

Many makers before marketing the cheese rub the rind with flour, barley meal, lime, whitening, etc., to imitate the white mould that is so popular among dealers, but if the cheese

is made under proper conditions and kept in the correct atmosphere on clean boards, a natural mould, which is much preferred, will grow on the coats.

A great difficulty that arises in some dairies is the growth of an objectionable black mould. This gets firmly established in the shelves and is difficult to eradicate. All affected cheese should be removed from the room, and the whole woodwork, floor, shelves, etc., well scrubbed with soap and water, and subsequently washed over with a solution of formalin (1 teaspoonful of 40 per cent. solution in a pint of water). The solution should be left wet on the shelves and allowed to soak in. This will usually destroy the mould. Care must be taken that the affected cheese is not touched before handling the new cheese, otherwise the latter will also become infected. Caerphilly cheese, if sent by rail, requires careful packing, preferably in partitioned boxes (two in each portion) made to take 8 cheeses.

The chief points in favour of the manufacture of Caerphilly cheese are (1) owing to the high yield (1 lb. 4 oz. to 1 lb. 6 oz. per gal. of milk) it is very profitable; (2) it can be made all the year round; (3) it is quickly marketed, and therefore gives quick returns and does not require a great deal of storage space; (4) the method of manufacture, as for all quick-ripening cheeses, is much simpler than the making of Cheddar: the risks are, therefore, not so great, and as the cheese is marketed quickly there is not the same period of time for harmful qualities to develop; (5) its manufacture does not take as long or require so much firing, etc., and both labour and working expenses are, therefore, lower.

THE MAKING OF CHEDDAR CHEESE.

There are numerous systems for the manufacture of Cheddar cheese, and the process varies in different districts and also as regards individual methods. Makers working on definite lines vary their methods according to the requirements of the milk they are using. This is due to the variations of soil in certain localities, and it is, therefore, very difficult to adhere to a hard and fast rule.

Cheddar cheese is usually made from morning's and evening's milk, and to be of good keeping quality the milk must be ripened, that is to say, slightly acid or sour. This condition of ripeness is difficult for the uninitiated to gauge, and where there is no long experience behind the maker, can only be judged accurately by tests. It may be brought about in two ways; first, by keeping the evening's milk at such a temperature

during the night that enough acidity will develop to ripen the morning's milk partially when it is added, and, secondly, by the addition of some ripening or souring agent, such as a starter, to the milk in the morning and allowing the milk to remain until sufficient acidity is obtained. The first and original method is satisfactory with careful handling, but the use of a good starter gives more reliable and uniform results, and thus compensates for the additional trouble required to make and keep the starter going from day to day.

In cases of emergency, when no starter is available, the ripening of the evening's milk is required. The milk, as soon as it is obtained, is strained into the cheese vat or tub, and, after being gently stirred to get rid of the "cowy" odour and to lower the temperature slightly, it is covered over to keep the desired heat and then left undisturbed during the evening. The temperature at which to leave it is only found by experience, for it is influenced by the time of year, the temperature of the dairy, and the amount and natural acidity of the milk. Usually in the late autumn and early spring 80° to 85° F. is found necessary, whereas in the summer 75° to 80° F. will be quite high enough, and the milk will be too ripe in the morning if this temperature is exceeded. Next morning this milk will have a distinctly acid smell and the cream will be in a thick layer on the surface. The cream is now skimmed off and placed in a pail to which some new milk is added, the whole being held in hot water to raise the temperature to 90° F. It is then poured back through a strainer (to break up any clots of cream) into the bulk of the milk and mixed evenly with the whole. If this is not done, and the cream is simply stirred in, it does not mix and a loss of fat results. The morning's milk is now added and the whole raised to renneting temperature. When using a starter the greatest care and attention must be given to keeping it pure and in good condition throughout.

The evening's milk, as soon as obtained and strained, is immediately cooled to 70° F. This is best done by running it over a refrigerator, as it not only cools the milk but also aerates it, and if the milk is run over quickly and the water so regulated that it is cooled evenly, the action of acid-forming organisms is not unduly checked. With jacketed vats or tubs, a steady stream of cold water through the jacket and the constant steady stirring of the milk answers the same purpose. The great point is to ensure that the milk is cooled as quickly as possible, and without rough handling, to prevent loss of fat; if stirred occasionally during the evening the cream will not

be in such a thick layer next morning. In any case, however, it is advisable to skim it off and treat in the same way as with ripened milk. When the temperature of the whole has been raised above 70° F. the starter may be strained in. The amount varies; usually from 1 to 2 per cent. is required, but enough should be used to give the correct amount of acidity for renneting 1½ to 2 hours after its addition.

The morning's milk may be added at any time, whether in bulk or as obtained, and when the whole quantity is in the vat it should be heated to the renneting temperature (80°–85° F.) and a test taken for the acidity. This should be 0·19 to 0·22 per cent. of lactic acid by the acidmeter, or 19–21 seconds by the rennet test, before the rennet is added, according to the time of year and the general condition of the milk. Rennet should be used at the rate of 1 dram to every 3 to 6 gal. of milk, according to the quality and quantity of the milk and the strength of the rennet. Before the rennet is added it should be mixed with 3 or 4 times its bulk of pure cold water and stirred into the bulk of milk for 3 to 5 minutes; 15 to 20 minutes later the surface of the milk should be stirred before the milk begins to curdle, to mix in any cream that has risen.

A curd firm enough for cutting should be obtained 45 to 50 minutes after adding the rennet; this is ascertained when it breaks cleanly over an inserted finger. The coagulum is then cut into cubes the size of small peas, with either American knives or some substitute. The main point in cutting is to see that the curd is cut cleanly and evenly, and is not smashed or broken. The cutting and subsequent stirring until the curd is in a loose condition should take 15 to 20 minutes, during which time the temperature should not be raised. The temperature necessary for scalding varies, even with the same method of make, on different soils, and may range between 92° F. and 102° F., the more general temperature being 95° to 98° F. The heating process must on no account be hurried, or the pieces of curd will become hard on the outside, while the interior will remain wet and uncooked; it should take from 35 to 45 minutes, the curd being well stirred meanwhile.

When the curd is in a springy condition, that is, if when a small quantity is taken in the hand it is found to resist pressure, it may be allowed to settle for 5 to 10 minutes and a test taken. If an acidmeter is used it should show a lactic acid content of 0·16–0·17 per cent., while if the hot-iron test is employed a ¼-in. thread should be drawn. If the acidity is lower than this, the whey should be left on the curd for 20 to

30 minutes to allow for further development of acidity; if over, the curd may be pushed at once into a compact mass away from the tap. When using a vat the curd should be pushed quite half way up the vat; it can then be cut into halves under the whey and the front portion floated on to that at the top end, the two pressed together and the whey drawn off. The curd should now be cut into convenient-sized blocks for handling (*e.g.*, 8 in. by 10 in.) and piled, either in the bottom of the vat or on the cooler, in layers, with a cloth in between. The depth of the piling depends on the bulk of curd; usually 3 to 4 pieces deep is the best depth for the first turn. The mass of curd is now left for 10 to 20 minutes, according to acidity, and then piled 6 to 8 pieces deep, again putting cloths in between. At the third piling the blocks of curd should have spread out and become thin enough to enable the whole mass to be placed one piece on top of another, no cloth now being necessary between them, except one which is left in the middle to obtain moisture for testing purposes. If enough acidity has not developed and more turns are necessary the curd (which should now be in thin sheets resembling chamois leather) may be folded at the turns. When ready for grinding it should be smooth and velvety to the touch, leathery in texture, and capable of being peeled off in thin strips and tied in knots, the joining of the granules of curd being hardly discernible, and a small portion bitten between the teeth resembling india rubber.

The amount of acidity necessary before grinding varies on different farms, according to the season of the year, the bulk of curd, and the temperature of the atmosphere, from 0.6–0.85 per cent. at this period giving the acidity of the press draining required. This latter should be 0.9–0.95 per cent., and the actual acidity before grinding must be judged accordingly.

The curd is now passed through a moderately coarse grinding mill, and after a thorough stirring salt is added at the rate of 1 oz. to every 3 lb. of curd, or $2\frac{1}{4}$ to $2\frac{1}{2}$ lb. salt to every 100 gal. of milk. The salt should be well mixed with the curd, and when the temperature of the latter is between 70° and 75° F. it may be pressed into cloth-lined cheese moulds or vats.

The cheese may now be put to press with a screw press only at first, and a test taken of the drainings. The acidity should be from 0.9–1 per cent. if a curd of average condition has been obtained. A moist, quick-working curd should be sweeter than a dry, slow one. The screw should be tightened at intervals, and the same evening the cloth carefully pulled up

round the cheese and straightened on top, and a pressure of 5-10 cwt. (according to the size of the cheese) put on. The next morning the cheese is taken out, turned and rubbed with grease one end and half way down the sides, a cap put on the greased end and a bandage put round the sides, the second cap being loosely placed on the top when the cheese is in the mould. The cheese should then be returned to the press and a pressure of 15-20 cwt. applied.

The second morning after making, the cheese is well greased the other end and the second cap put on, the bandage being removed half way to catch in the corners of the second cap when put back. The pressure may now be increased if very large cheeses are being made, but for 80 to 90 lb. cheeses a pressure of 1 ton is enough. The next morning the cheese should be removed from the press and an outer bandage put on, and then taken to the ripening room and kept at a temperature of from 58° F. to 65° F. The cheese should be turned daily for at least the first fortnight after making (or the moisture will drain to one end); afterwards, every other day will be sufficient.

A well-made Cheddar cheese will develop a good flavour and texture in from 2 to 3 months and should, if kept under satisfactory conditions, retain its good qualities for 12 months.

OIL FROM BRITISH-GROWN LINSEED.

WITH the view of meeting the increasing demand for information regarding the cultivation of flax, the British Flax and Hemp Growers' Society, Ltd., have, from time to time, issued notes dealing with technical details regarding this crop. In view of the shortage of feeding stuffs and of oil in the country as a result of war conditions, the Society considered it desirable to communicate the results of the investigations which have been made on the subject of growing linseed as a farm crop in this country. Papers were, therefore, written by Dr. J. Vargas Eyre, M.A., dealing with the agricultural possibilities of oil production in England, and by Dr. R. S. Morrell, M.A.,

F.I.C., on the commercial value of the oil produced. These papers were issued by the Society in the form of a pamphlet (Notes on Flax, VI.) from which the extracts printed below have been taken.

The Agricultural Possibilities of Oil Production.—For some years a good deal of attention has been given to the question of growing this valuable oil-bearing crop in England. The view was taken that efforts should be made to introduce the cultivation of linseed as part of the agricultural practice of this country, in view of the increasing demand for linseed cake on the farm, and of the growing demand for linseed oil by several important industries. The problem was regarded as one of growing oil per acre, and during the course of these trials a great deal of information from this point of view has been obtained. In the past the development in England of linseed as a farm crop has suffered through want of knowledge concerning its requirements, and by reason of the fact that no systematic tests had been made to establish which of the many varieties is the best to grow in this country. In addition, there was a lack of knowledge as to the real value of the linseed oil obtained, it having been placed on record and believed by many that linseed raised in this country was inferior to that which could be imported, and that the oil contained was less in quantity and less in value than that which comes from imported seed.

In the first place variety trials were made, which included the growing of the most likely kinds of linseed from the point of view of yield of seed in conjunction with the oil-content of the seed produced. These trials have been conducted during several years on widely different types of soil and under different agricultural conditions. From the analyses of the seed produced and the yield of seed per acre a comparison has been made each year of these varieties on the basis of oil per acre, and it has been found, without exception, that the variety coming from South America, known as "La Plata" or "Plate" linseed, gave the best results.* During four seasons the trials have shown that on moderately poor soil the yield of dressed linseed amounts to 10 cwt. per acre, on good medium land 15 cwt. and on very good land as much as 20 cwt., and the average oil-content of "La Plata" seed, when grown in this country, is as high as 40 per cent. The following results obtained at Wye illustrate this point:—

* *Journ. Agric. Sci.*, 1915, VII., i., p. 120.

Comparative Values of different Types of Linseed as Oil-producing Crops at Wye College.

Type of Seed.	Yield per Acre.	Percentage Oil.	Oil per Acre.
	Cwt. lb.		Cwt.
Moroccan	12 25	42·9	5·25
Dutch	11 86	37·7	4·43
La Plata	14 70	42·8	6·26
Steppe	13 53	41·5	5·60
Baltic	6 28	34·0 to 35·6	2·18

Excellent linseed has been obtained which compares very favourably in general appearance with imported linseed, and in so far as size of seed and oil-content are concerned, English-grown linseed shows a marked superiority over the imported seed from which it is raised. The following representative data will show this clearly :—

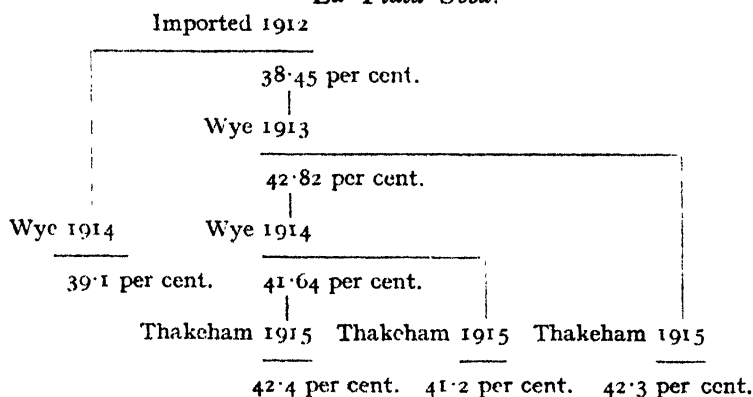
La Plata Seed.	Weight of 1,000 Seeds.	Oil-content.
	Gr.	Per cent.
1913. Imported seed	6·108	38·45
	8·840	42·80
English linseed raised from above im- ported sample on four different farms.	9·204	39·69
	7·712	37·72
	8·744	41·35

Similar results to the above were obtained during 1914-1915 from experimental plots in various parts of the country, and in 1916 the following figures, representing samples received from nine farmers who had been induced to grow linseed as a farm crop, gave further evidence of this fact :—

La Plata Seed.	Weight of 1,000 Seeds.	Oil-content.
	Gr.	Per cent.
1916. Imported seed	6·4210	38·8
	7·1602	41·5
	8·5324	40·5
	8·1771	39·7
	7·6272	42·1
English-grown seed from the above im- ported sample on nine different farms.	8·2201	42·4
	7·9630	41·3
	7·1055	39·4
	7·7637	39·7
	8·3570	39·8

In view of the opinion expressed in some quarters that this high yield of oil is not maintained season after season, and that home-saved linseed raised repeatedly in this country becomes steadily deficient in oil, trials have been carried out since 1912 designed to test the accuracy of this contention. It will be seen from the following figures obtained from the analyses of the various samples of linseed, raised repeatedly from the same stock at Wye, in Kent, and at Thakeham, in Sussex, that a decrease in the amount of oil is not actually found in practice. Indeed, it appears that the superiority of the home-grown seed over the imported seed is well maintained.

La Plata Seed.



In view of the foregoing results, the value of English-grown linseed as a source of oil is seen to be very great. If all the oil be expressed, a yield of from 50 to 70 gal. of oil per acre may be obtained, or, if the linseed be pressed to form a standard cake, as much as 35 to 45 gal. of oil per acre will result. This may be seen from the following table:—

La Plata Seed. Basis of Oil per Acre.

Yield per acre $\left\{ \begin{array}{l} 10 \text{ cwt.} \\ 15 \text{ " " " " } \\ 20 \text{ " " " " } \end{array} \right\}$ of dressed seed.

Oil content 40 per cent.

A—Total Expression of Oil; or B—for Cake containing 10 per cent. Oil.

A—Yield of Oil when totally expressed.		B—For Cake Expression.	
	Gal. per Acre.		Gal. per Acre.
10 cwt. seed per acre..	48	10 cwt. seed per acre ..	36
15 " " " " ..	72	15 " " " " ..	54
20 " " " " ..	96	20 " " " " ..	72

In view of the present scarcity of drying oils* the desirability might well be considered of expressing all the oil from the linseed and then adding some less valuable oil or fat to the extent of, say, 10 per cent., so as to bring up the food value of the resultant cake.

Growing the Linseed Crop.—The raising of good linseed crops in this country presents no difficulty to the agriculturist.† It is a crop which requires no special kind of soil, flourishing well on any good medium land. As far as present records show, it appears that the best results are obtained on the heavier types of loam. Generally speaking, linseed is a crop which follows well after corn, and it is the best practice to grow it after a straw crop of some kind. It has been shown clearly that wheat does well after linseed, and there is ample evidence that it does not draw the land more than other crops of a similar kind.

Wheat following Linseed and Oats.‡

Wheat.	Head Corn.			Tail Corn.	Straw and Chaff.			Value per qr.
	Weight in lb.	Bush.	Weight per bush.	Weight in lb.	Weight.			
After linseed and 12 tons dung per acre	1,551	24'3	63'8	49	T. c.	q. lb.	s. d.	
After linseed	1 586	24'6	64'4	49	1 0	2 23	59	0
After oats	784	12'1	65'0	26	0 19	1 14	59	0
					0 9	2 11	59	0

It must be emphasised that linseed is, perhaps, one of the best crops to have on newly ploughed-up pasture land, as it is not attacked by wireworm, and even when the land is comparatively roughly ploughed, excellent crops of linseed have been raised. In many districts farmers gladly take advantage of the fact that linseed may be sown with clover or "seeds" underneath.

It is of great importance to have the land deeply worked and firm, with but a shallow surface layer to cover the seed after sowing. Linseed germinates very readily and grows away rapidly, and to meet these requirements the land should be in good condition. It is not desirable to sow this crop on land which is in a very high state of fertility, as it appears that under

* Linseed oil is now £20 per ton.

† "Linseed as a Farm Crop." See this *Journal*, February, 1916, p. 1069.

‡ *Roy. Agric. Soc. Woburn Exp. Stn. Rep.*, 1915, Table VIII.

these conditions luxuriant growth is induced without a proportionate increase in the amount of seed produced. Generally speaking, unless the soil is poor, no very marked increase in quantity of seed is brought about by the application of artificial manures, certainly no change has been observed in the oil-content of the linseed following such treatment. Farmers generally know from experience how best to apply manurial dressings to secure good corn crops on their land.

With regard to sowing the seed, it is an advantage to have the seed sown as soon as the soil and weather permit, so that germination may take place evenly and the plant make a good start while moisture is in the top soil. Usually it is possible to sow on the lighter land towards the end of March or the beginning of April, and on the heavier land before the end of April. The advantage of early sowing is apparent at harvest time, as it means that the crop will be off the land prior to the usual corn harvest, and allow of a catch crop being taken on the same land. The sowing is best performed by drilling, the coulter being set to a distance of about 6 in. apart, or a seed-barrow may be used with good results. The seed should not be deeply buried; about $\frac{1}{2}$ in. below the surface of the soil is the best. With good samples of sowing seed on an average soil the quantity recommended for sowing is 80 lb. per acre.

It is essential that the land upon which linseed is sown should be moderately clean and free from weeds, and, under these circumstances, it is not necessary to do more than remove, by spudding, the larger weeds such as docks and thistles. After about 100 days have elapsed from the time of sowing the crop is usually ready for harvesting. This may be ascertained by carefully examining the plants and observing whether the majority of the capsules contain full plump seeds which are just changing from a green colour to pale brown; a degree of ripeness which is generally reached early in July when the lower leaves on the stem have withered and fallen. Linseed continues to flower for some time and consequently ripens unevenly in the field, carrying both ripe and green capsules at harvest time, but this is not detrimental to good harvesting, because, like wheat, it ripens in the stook. It has been ascertained by experiment during the last two or three seasons that nearly all the oil which is ultimately contained in the seed is laid down prior to the stage of development referred to as that at which it should be harvested.* The after-ripening processes which go forward after the crop is cut raise the oil-

* *Journ. Agric. Sci.*, 1915, VII., i., p. 122.

content of the seed to the figure given. It is not wise to allow the crop to stand until the majority of the capsules are fully ripe, because this entails considerable loss of seed when the crop is harvested, and the oil expressed from the seed has been found by experiment to be of no greater value.

When the area of linseed to be harvested is small it is best to cut the crop with a scythe, but with larger areas an ordinary binding or reaping machine requires very little adjustment to deal with the crop satisfactorily; the matter of importance being that the knives should act quickly and be very sharp. The sheaves should be made up small so as to allow drying to proceed rapidly, and these should be "shocked" in the field in the ordinary way and carted when dry.

As soon as the land is cleared of the linseed it is a good practice to follow on with a crop of white turnips, unless seeds were sown with the linseed in the first instance.

The best method of threshing linseed is to use an ordinary threshing machine, and to achieve the best results the following adjustments are recommended: About two-thirds of the "cavings riddle" should be covered to prevent any large amount of the cavings falling through the riddle along with the seed and the chaff; the ordinary-sized riddle being large enough to allow unbroken seed bolls to pass through. A $\frac{3}{16}$ -in. "chob" riddle is recommended. The unbroken seed bolls should be passed through the drum a second time. Unless the drum of the machine be set close and a high speed maintained, and the straw be carefully fed into the machine, it may be necessary to pass it through a second time to remove all the seed. Linseed being much smaller than the seed of other grain crops only the finest riddle should be used.

Linseed straw is remarkably tough and wiry, rotting down very slowly. For this reason it does not make good litter for stock. On the farm it is found to be useful for stack-bottoms, and for the bottom of covered yards, and it is very useful for thatching purposes. The straw coming from the ordinary threshing machine is somewhat broken and tangled, but if put up into press-packed bales it may be sold for about £4 to £5 per ton. The prospects of making paper from linseed straw do not appear to be good. Although it makes a very tough paper, it requires such prolonged treatment with alkalis to render it of good colour and texture that paper makers are not inclined to use much of it at the present time. The chaff from the linseed crop consists almost entirely of the remains

of the broken seed capsules. This may be fed to stock in the same way as other grain chaff, ewes being particularly fond of it.

It is difficult, under present circumstances, to give more than a general idea as to the cost of growing linseed as a farm crop. The Society's returns show, in a large number of cases, the cost of production to be about £8 10s. per acre; the cost, however, should certainly not be more than £10 per acre.

The figures obtained during the past four years show that when using "La Plata" seed a crop of about 15 cwt. of dressed seed, containing 40 per cent. oil, may be expected under moderately good conditions. At the present time, when the price of linseed is about £45 per ton, an average crop should be worth £33 15s. per acre, without taking account of the straw or the chaff. The yield of straw has varied between 21 cwt. per acre and 9 cwt. per acre, depending upon whether the soil is good or poor. As already stated this can be sold at the present time, if put into press-packed bales, at £4 to £5 per ton. There is, in addition, about 7½ cwt. of chaff per acre, which has recently sold at £5 per ton. The value of the straw and chaff, therefore, may be put at about £5 per acre, which brings up the total value of the linseed crop to nearly £39 per acre.

The Commercial Value of Oil Produced.—The examination of English-grown oil has extended over three years. Small quantities of the 1915 oil available from laboratory-pressed seed were followed by a ½-ton lot of the 1916 crop, whilst 3 tons of linseed oil from the 1917 crop enabled proper works trials to be undertaken. The comparison of the three years' trials confirmed the opinion as to the quality of the oil. Its properties may be described as those of a super Baltic oil.

If the quality of the seed is maintained linseed oil from English-grown seed will always command the highest price in the market. This superiority in quality will go far to neutralise any disadvantage arising from higher cost of production. It is recognised in the trade that Baltic oil has peculiar properties, which make it in especial demand by producers of higher grade varnishes and paints. The superiority of the English-grown oil, if the supply were assured, would enable manufacturers to be independent of any restriction as to oil from Russia. The examination of the linseed cake as a cattle food shows that its feeding value tested under war conditions is equal to linseed cake at present available. The very favourable results obtained may be due to the special parent Argentine

seed and to climatic conditions. From the results of the trials which have been carried out it is suggested that a much larger acreage be devoted to linseed grown for seed only.

There is now in England the certainty of producing an appreciable quantity of a high-class oil.

LIQUID MANURE.

SUGGESTIONS for the construction of liquid manure tanks have recently been published by the Board and are reproduced at p. 431. The object of the present article is to give a few notes as to the value and use of liquid manure.

Value.—The urine of animals contains nearly all the potash and a great deal of the nitrogen which passes through their bodies. It contains only a small amount of the phosphate, the bulk of this being voided with the dung. Further, it contains these important plant-foods not in solid form but in solution, ready for the immediate use of the plant. Moreover, the loss from manure kept in the ordinary way, is, owing to fermentation and drainage, a very serious item. Liquid manure, however, by the use of simple appliances and by care, can be kept without losing much of its manurial value. An average sample, undiluted, should contain up to 2 per cent. of nitrogen and 46 per cent. of potash, and 1,000 gal. are equal in value, roughly speaking, to about 3 cwt. of kainit and 100 lb. of sulphate of ammonia. At pre-war rates the value would be about 4s. 6d. per ton (224 gal.)—at present rates considerably more. Irish experiments have proved that liquid manure, applied at the rate of 16 tons per acre to hay land, gives rather better results than the same weight of farmyard manure, or than 1 cwt. nitrate of soda, 2 cwt. superphosphate, and 2 cwt. kainit. Fertilisers and feeding stuffs are still expensive, and every effort should be made to save money on the former by using the manurial residues of the latter to their fullest extent. The liquid manure should, therefore, certainly not be allowed to run to waste. This applies not only to the urine but to the drainage from dungsteads, yards, etc.; this, though not so valuable, should also be collected and run into the tank.

Reasons why Liquid Manure has not been much used.—If liquid manure is so valuable, why has its use been comparatively

neglected? The answer to this question depends on several factors :—

- (1) "It is inconvenient to have to empty the tank regularly." It has been found, however, that one man, one horse and one boy with a liquid manure cart, can cover about four-fifths of an acre per day, at a rate of 1,500 gal. per acre. This quantity would represent a month's supply, undiluted, from about 40 head of cattle and horses. Even if liberally diluted its distribution would not require more than a couple of days.
- (2) "The storing of liquid manure has been regarded as insanitary." With a properly constructed tank, however, this objection is entirely removed.
- (3) "It is objectionable to handle"—but with proper distributing apparatus very little "handling" is required.
- (4) "It is liable to 'burn' vegetation." This is true if the liquid is applied too strong, but a little experience will soon show how much water should be used to dilute it.
- (5) "Carts for distributing liquid manure are expensive and if of iron are likely to corrode." Carts with iron fittings are expensive and the iron requires careful attention, but for practical purposes a wooden puncheon or barrel fixed on to a bogey is equally effective, distribution being obtained by means of a wooden trough with holes. This trough can be left in the field and fixed again when the cart returns. The length of the trough is generally a little more than the width between the wheels of the cart.
- (6) "Its value has not been sufficiently appreciated and its treatment not sufficiently understood." This is probably the true reason for the neglect of liquid manure.

The Uses of Liquid Manure.—Liquid manure is especially useful for application to the following crops :—

<i>Crop.</i>				<i>Time.</i>
Meadow Hay	..	..	..	Autumn to May.
Autumn-sown catch crops	..	..	..	} Early spring.*
Young "seeds," especially rye-grass	..	..	..
Aftermath	..	..	..	After the first crop.
Pastures	..	..	..	Winter.

* One or more liberal dressings during February and March will have the effect of forcing the crop and producing a heavy cutting in April or early in May, just when supplies of winter forage are running short.

	<i>Crop.</i>				<i>Time.</i>
Cabbages	Spring.*
Mangolds	Late spring.*
Root crops	Before sowing.

Method of Distribution.—In some, but not many, cases, distribution by irrigation may be possible. In such cases, in order to ensure its reaching all the ground, the liquid manure should be well diluted before being run over the land. For general use, a barrel on the body of a cart, as suggested above, with a perforated trough or a flat semi-circular fan, divided with battens, radiating from a box in the centre, into which the tap of the barrel delivers, will probably be found the most suitable arrangement. The tap will regulate the rate of distribution. A permanent system of pipes will only pay under a system of intensive culture.

Dilution.—When applied too strong to grass or growing crops liquid manure is apt to “burn.” No definite rule can be given as to the exact amount of water that should be added, as the strength of the liquid depends both on the nature of the food of the cattle and on the amount of water other than urine that runs into the tank. While it is advisable, for economy of storage, to allow as little water as possible to enter the tank, the water used in washing down a cow-shed will contain a certain amount of manurial ingredients and may, unless it makes it necessary to empty the tank too often, be allowed to run in. In this case there will be little danger of “burning”; otherwise it will be well to experiment before applying the manure. If it is found to burn, then it will be necessary to add water. It is also advisable not to apply it to growing crops in dry weather, to avoid “burning,” while application in wet weather ensures speedier mixing with the soil. In the case of grass land the manure should be applied preferably when the grass is wet with dew or rain. When applied to uncropped land, no dilution is necessary.

Rate of Application.—The rate of application will depend both on the strength of the liquid and on the number of applications to be given in a season. If it be borne in mind that 1,000 gal. of average undiluted liquid manure contain nitrogen equivalent to 100 lb. of sulphate of ammonia, it will be easy to regulate the amount.

Remarks.—There are two main points to be remembered. First, that the more liquid manure is kept from the air, the better does it keep its value. No air must reach it through

* In this case it should be applied and hoed in between the rows with as little delay as possible.

the top of the tank or through the covering of manholes. The second point is that no solid manure must accompany the liquid into the tank. The presence of solid manure, whether dung or straw, will tend to set up fermentation, and fermentation means loss. Another advantage gained by keeping the liquid free from solid manure is the greater ease with which it can be spread, as solid matter tends to block the distribution holes. To clean these it may be necessary to have a boy walking behind the cart. Where solid matter is allowed to get into the tank it is advisable to stir the liquid before pumping so as to bring as much of the sediment as possible into the cart and thus save the very dirty work of clearing out the tank with buckets. With a proper tank, however, there should be very little sediment. The design given in the article printed below provides for a settling chamber which will require regular, but not frequent, cleaning.

(This article will be issued separately as Leaflet No. 332.)

PRACTICAL SUGGESTIONS FOR THE CONSTRUCTION OF LIQUID MANURE TANKS.

A Dressing of 1,500 gal. of Liquid Manure to the acre is equal to applying 150 lb. of Sulphate of Ammonia and 4½ cwt. of Kainit.

That such a valuable material should be allowed to run absolutely to waste in the majority of farms is not only a loss to the individual farmer, but to the nation also.

With a view to helping agriculturists who are willing to collect and utilise this important asset, the Board put forward the following suggestions as to suitable means which may be adopted for the handling and distribution of Liquid Manure.

It is estimated that, even at the present time, the cost of the whole installation would in most cases be recovered within a very short time by the saving in artificials which it would effect.

The arrangements needed are of the simplest description, and, provided the few important details of construction described in this article receive careful attention, there should be little difficulty either in installing or using the system.

The installation—illustrated in the sectional diagram, Fig. 1—begins at the drainage channel in the cow-house in which

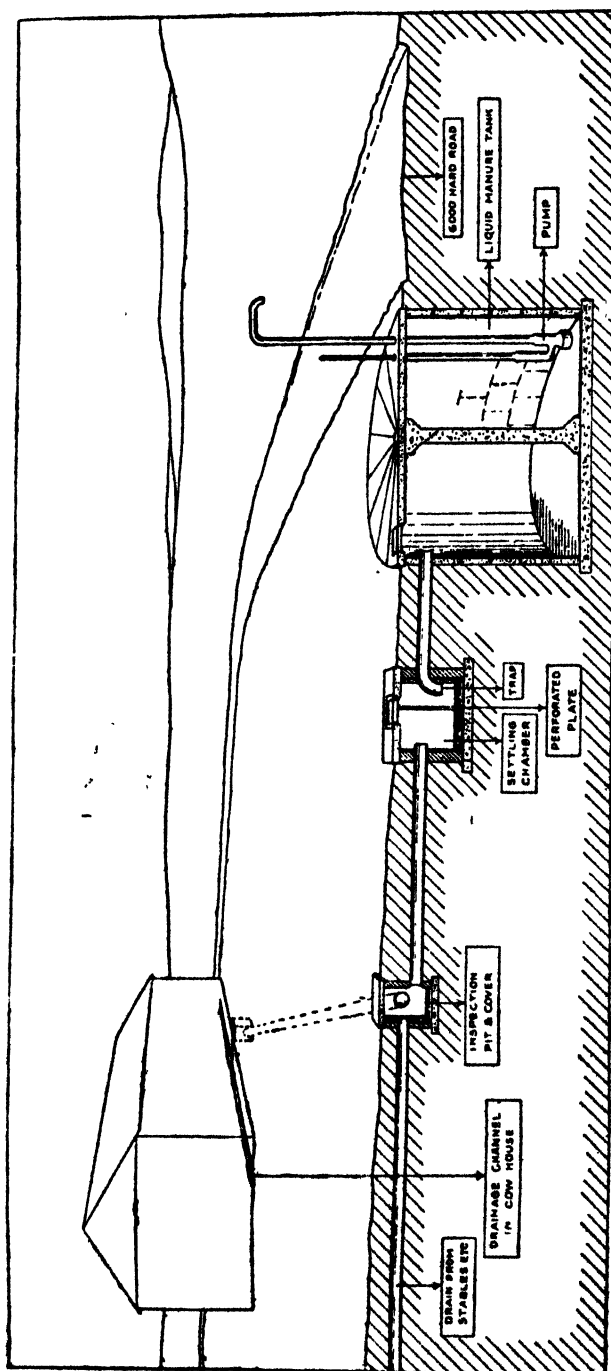


FIG. 1.—Sectional View of Complete Liquid Manure Installation.

the liquid manure is collected. The liquid is led through glazed pipes to a settling chamber containing a strainer. From the settling chamber it may pass either directly, or through connecting pipes, to the main storage tank, whence it is pumped into distribution carts.

Drainage Channel in Cow-shed.—The purpose of this channel is to effect the separation of the liquid from the solid in the most complete way possible. It is best done by following the design shown in Fig. 2. The actual dimensions there given should be adhered to. The half-round channel should be of glazed stoneware, the other portions of concrete, with a rendered cement face. From the drainage channel the fluid runs through glazed pipes jointed in cement, and not less than 6 in. in internal diameter, to catch a pit, Fig. 1, where the more solid particles collect.

In order to assist in keeping the pipes clear of ob-

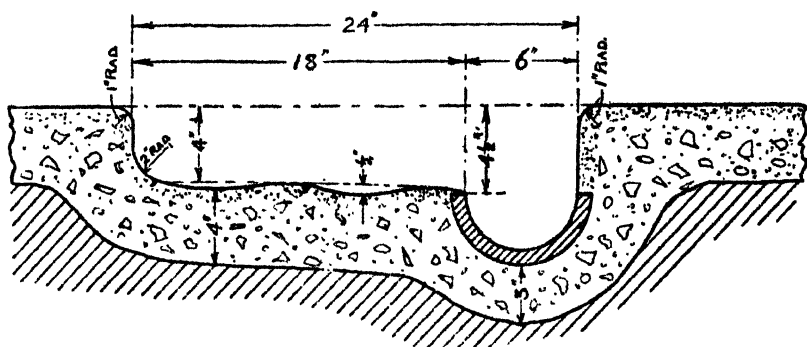


FIG. 2.—Drainage Channel (Section).

structions it is a good plan to leave an old chain lying in them. By pulling this backwards and forwards between inspection pits a clearance is easily effected. Even an old piece of wire strand instead of the chain is better than nothing.

It is advisable to insert a perforated partition (iron plate will do) in this chamber to filter off the lighter portions, bits of straw, etc.

The separation plate should be arranged to slide in guides so that it can be easily removed. The cleaning of the settling chamber and separation plate can be done by opening the man-hole cover in the top of the chamber, which is made wide enough to allow of the withdrawal of the perforated plate.

From the separating pit the liquid portions pass out through a trapped connection to the main collecting tank. The trapping may be conveniently effected by inserting a bend at the

end of the pipe connecting the separation chamber with the main tank, as shown in Fig. 1. It is important that this connection should be trapped to prevent the escape, and therefore waste, of ammonia, which is being continually liberated from the liquid in the main tank.

The settling chamber should be built either in masonry, brick work, or concrete rendered on the inside with 1 in. Portland cement and sand, mixed three to one.

Where possible, it is convenient to arrange so that the settling pit and main tank are on a part of the land at a lower level than the cow-house and other stables to be drained, since this will enable them to be placed with their tops at ground level, a matter of convenience when removing the manhole covers for cleaning. The pipes must be carefully laid to falls, and at every change of direction an inspection cover (see Fig. 1), must be fitted so that they can be easily rodded through, in case they become blocked.

Storage Tank.—In order to comply with the requirements for the production of pure milk, the storage tank must be placed as far as it conveniently can from the cow-house.

The size of the tank should be proportioned to suit the head of cattle which it serves, and to the length of time during which it may be necessary to leave it undischarged (owing to bad weather, or season of the year). As a general rule it will be found that an allowance of 12 to 15 c. ft. of tank capacity per head of cattle served will meet practical requirements. For convenience of reference, the following table has been prepared upon this basis. In the case of the larger tanks alternative dimensions are given for deep and shallow tanks, since where the site is bad or very wet it will be found advisable on constructional grounds to use a shallow tank.

Head of Stock.	Tank Capacity.		Tank Dimensions.					
	C. ft. Gal.		Rectangular.			Circular.		
			Length. ft.	Width. ft.	Depth. ft. in.	Depth. ft. in.	Diameter. ft.	
10	150	937	8	5	3 9	5 4	× 6	
15	225	1,400	10	5	4 6	6 0	× 7	
20	300	1,870	10	5	6 0	6 0	× 8	
30	450	2,720	12	5	7 6	7 0	× 9	
50	750	4,680	12	10	6 3	9 6	× 10	
			18	12	3 6	4 3	× 15	
75	1,125	7,000	12	10	9 6	10 0	× 12	
			20	12	4 9	4 6	× 18	
100	1,500	9,370	15	10	10 0	8 6	× 15	
			20	15	5 0	4 9	× 20	

The selection of the material and type of construction to be adopted for the tank are matters so dependent on the local conditions and supplies that it is only possible to indicate the various designs, without making any comparison between them. All tanks should have concrete bottoms, which should be reinforced sufficiently to prevent cracking. No illustrations of tank designs are given (except the one shown in Fig. 1), since the variations to suit individual cases are almost limitless, but the Board will give advice as to design, and supply the names of firms who may be willing to organise the work of construction, using the farmers' materials and rough labour, or to tender for the execution of the work complete, when applications with full particulars are received. Letters concerning liquid manure appliances should be addressed to the Commercial Secretary, Board of Agriculture and Fisheries, 72, Victoria Street, London, S.W. 1.

Brick and Masonry Tanks.—In the smaller sizes, these may be either rectangular, with arched roofs, or circular in plan, with either domed roofs or arched roofs carried on supporting joists, but for large, deep tanks the circular type is to be strongly recommended. The brickwork side walls should be reinforced in the case of the rectangular tanks in all except the smallest sizes. Nothing less than 9-in. brickwork should ever be used in these walls, and all bricks should be laid in Portland cement mortar.

In Situ Concrete.—With suitable reinforcement this material may be used for any of the sizes, either round or rectangular, for floor, walls and roof. To prevent cracks developing it is recommended that some reinforcement should be used in all cases, whether strictly required by stress considerations or not.

An alternative *in situ* construction consists in concrete plastering applied to one of the various steel lathings which are on the market. This method avoids the use of wood centring, which is frequently found a difficulty in the hands of inexperienced workmen. A flat roof supported on one or more joists can be conveniently built with this type of reinforcement.

Concrete Block and Slab Designs.—It may not infrequently happen that the walls and roof of the tank can be more easily and cheaply built by the use of the moulded slabs and columns, which are commercially obtainable in some districts. The slabs used should be scratched (when made) on one side so as to give a "key" to hold the rendering. The circular tank

shown in section in Fig. 1 is of this type. Only three moulds are needed for it ; one for the central column, one for the roof slabs, and one for the wall slabs, the size and shape of which are indicated by broken lines in the diagram. A tank of this type can be either made from stock sections or the slabs may be cast on the job.

All tanks, of whatever construction, should be rendered inside with $\frac{3}{4}$ in. or 1 in. of Portland cement mortar mixed three parts of sand to one part of cement ; with this may be incorporated, with advantage, one of the water-proofing compounds sold for use with Portland cement.

Great importance attaches to making the tank absolutely water-tight and air-tight, since, in order that the ammonia may be retained, it is essential that the air space over the liquid in the tank should be hermetically sealed.

Manhole Frame and Cover.—The frame should be securely grouted into the concrete of the roof and the cover should be rendered air-tight either by a grease joint or a rubber joint ring.

The Pump.—In selecting a pump for delivering the liquid manure into the distributing cart, care should be taken to choose a design in which there are no small parts in the valves and few moving or wearing parts. The ordinary types of chain and bucket pumps have proved unsatisfactory, and it is recommended that a pump specially designed for the purpose, such as the "Simplex" or "Premier," be employed. *Whatever pump is used, the joint where it passes through the top of the manure tank should be made, and kept, air-tight, either by being grouted with Portland cement, or packed with grease packing well caulked down.*

The Distributing Cart should have a spraying device capable of adjustment and easily cleaned out should it become blocked. The wheels should be of large diameter and fitted with broad tyres. The weight of the liquid is considerable, and it is important that the cart should be able to go out in almost all conditions of the ground. The types provided with attached pumps are not recommended, because the pump adds to the weight and no air-tight joint can be secured at the hole where the suction pipe passes into the tank, since it has to be constantly moved.

*(This Article is also issued separately as a leaflet,
known as F.P. 449/S. 1.)* .

THE agricultural education section of the Royal Show at Cardiff included exhibits by the University Colleges of Cardiff, Bangor, Aberystwyth and Reading, Rothamsted Experimental Station, the Flax Production Department of the Board, the Meteorological Office, the National Museum of Wales, Cardiff Public Library, the National Clean Milk Society, the National Utility Poultry Society, and the Agricultural Education Association. The Cardiff College exhibit covered most sections of agricultural science, but the other exhibits were generally restricted to the results of recent investigations or to questions of immediate importance. The education section may be most conveniently described by mentioning some of the more outstanding features, grouped according to the branch of agriculture concerned.

The University College of Cardiff had maps and specimens showing the relations between the geological formations and types of agriculture in Glamorgan. Sheep farming was shown to be general on the higher coal measures, with dairying in the valleys, whilst arable farming is confined to the lower stretches of lias and limestone.

A more extensive and detailed series of maps summarised the present position of the survey of the Paleozoic soils of North Wales, which is being carried out by the University College at Bangor. The principal soil types have now been mapped out and analysed. Tubes containing samples of these soil types, divided up into the various fractions—sands, silts, clay, etc.—showed that in general they are well balanced and contain very little true clay. Soils from considerable areas in which farming is carried on successfully are markedly high in organic matter and low in lime.

The exhibit of the Aberystwyth College dealt with a problem of particular interest in certain parts of Wales, *e.g.*, Cardiganshire, where tracts of soil are rendered infertile by the presence of toxic metals from old mines. The effects are not confined to the immediate neighbourhood of the mines, as the metals are distributed over considerable areas by the flooding of the trenches conducting water from mine to mine, or by the overflowing of rivers which contain in their beds deposits of the mine refuse which was formerly run into them. When this method of disposal of mine refuse was prohibited, it was built up into large heaps, from which the toxic metals are now distributed by the action of wind. On the affected soils arable crops are considerably reduced, especially in dry seasons, and

the pastures produce a poor herbage, which is devoid of clover and is sometimes poisonous to stock. Experiments in pots and fields have demonstrated that, whereas complete manuring is without effect, liming is a permanent remedy.

A series of turfs in the Bangor College exhibit illustrated the results obtained by the application of various phosphatic and calcareous manures to certain types of poor acid pastures in North Wales in districts of fairly high rainfall. Superphosphate, ground lime or ground limestone, had produced no effect, and whilst superphosphate with lime had brought about a slight improvement, basic slag or ground mineral phosphate showed very considerable and about equal improvements. On pastures of this type, where superphosphate is without effect, ground mineral phosphate is now always recommended. The Rothamsted exhibit included a series of turfs from normal grass land and from closely adjacent land, which showed, both by their herbage and by chemical analysis, a rapidly increasing need for lime. Other boxes showed the effect of lime starvation on arable soil. Rotation clover had failed on a soil deficient in lime, whilst on another portion of the same field adequately supplied with lime a good crop of clover was secured.

Several of the Rothamsted exhibits were devoted to the results of experiments with various manures—old and new. Specimens of wheat summarised the results of the Broadbalk experiments on continuous wheat-growing, and model hay stacks showed the effects of various systems of manuring meadow hay, bringing out both the effects on total yield and on the quality of the hay produced. Experiments with equal quantities of farmyard manure which had been stored under cover and in the open gave an increase of about 15 per cent. as a result of storing under cover. Another exhibit illustrated the beneficial effects of residues of farmyard manure, as compared with the residues of artificial manures, on clover and through the clover on the succeeding crop, the facts in relation to which were recorded in this *Journal* for May, 1919, p. 124. This new demonstration of the importance of farmyard manure added even to the intrinsic interest of samples of artificial farmyard manure, also included in the Rothamsted exhibits. These samples were prepared by fermenting straw, and resembled ordinary farmyard manure both in appearance and in content of nitrogen and organic matter. Several new fertilisers which have given promising results were also shown ; they included potassium chloride prepared from blast furnace

dust, activated sewage sludge containing 7 per cent. of nitrogen, and two fertilisers from waste products of the War—ammonium nitrate and a material prepared by decomposing cordite. Amongst other war products under investigation are poison gases, which are being used for the partial sterilisation of "sick" greenhouse soils; and acetone tar, which has given very satisfactory results as a seed dressing for protection against birds.

The University College of Bangor had a collection of oats and grasses at present under investigation in North Wales, and the University College of Cardiff showed specimens of plants which were poisonous to stock or which tainted milk.

The Flax Production Branch of the Board of Agriculture showed photographs of the farming operations in the cultivation of flax, which now occupies about 13,000 acres. There were also exhibited samples of flax from several centres, and of the by-products, linseed oil and cake, and samples illustrating the progressive stages in the conversion of the harvested crop into flax fibre and articles manufactured therefrom, e.g., aeroplane cloths, thread, cording, ships' canvas and tow.

Several exhibits dealt with the fungoid and insect pests of the farm and garden. University College, Reading, showed a comprehensive series of excellent coloured diagrams and specimens of pests. The National Museum of Wales exhibited many cases of insects and the damage caused by them, and also useful birds with descriptions of their food. The exhibit of Rothamsted differed from these in that it was confined to one species of each.* The fungus *Botrytis cinerea* was shown growing on such varied hosts as apples, tomatoes, onions, lettuce, potato-haulm, and tropical fruits, thus showing a wide distribution. The case with which it spreads was illustrated by large diagrams of the fungus and by the germination of the sclerotia formed in the previous winter on weeds. The wireworm was shown in various stages of development: the egg, the larva or wireworm at various ages from five days to five years, the pupa and the perfect insect or click beetle. Other cases contained the larva, pupa, and beetle of the more common species of click beetles, closely allied and less injurious species, and a collection of other animals, some of them beneficial, which are sometimes mistaken for wireworms.

The National Clean Milk Society's exhibit aroused considerable interest in the need for and the possibility of producing clean milk. The unsatisfactory condition of the present milk supply was forcibly brought out by tables giving

the results of bacteriological examination of milk as supplied to London Hospitals and Schools for Mothers. The numbers of bacteria were exceedingly high ; every sample examined showed the presence of organisms derived from manure ; and in 10 per cent. of the samples living tubercle bacilli were found. Photographs showed the extremely unhygienic conditions under which much milk is being produced at the present time, and, by way of contrast, further photographs and a model barn from farms now producing Grade A milk in this country. It is maintained by the Society that such modern equipment is not essential, and that under the conditions obtaining on an ordinary farm it is possible to produce clean milk from healthy cows, provided careful attention is given to the cleanliness of utensils, the grooming of the cows, the use of a covered milking pail, the immediate cooling of the milk, etc. Charts showed that clean cooled milk had kept twice as long as ordinary un-cooled milk under all the conditions tested, and illustrated the importance of storing milk at the lowest temperature possible.

In view of the frequent contamination of milk from the manure heap an investigation is being carried out at University College, Reading, on the presence and viability of tubercle bacilli in the fæces of apparently healthy cows. Of 264 cows examined, 5 were found to be excreting living tubercle bacilli in their dung, and it was shown that the bacilli can live at least four months in dung applied to pasture land and at least twelve months in stored manure. A bacteriological examination, conducted over a long period, of milk collected in the ordinary and in the covered milking pail, proved that, provided both were sterilised, the covered pail gave much cleaner milk, but that, unless the sterilising be done, the covered pail may serve as a source of contamination and give less clean milk than the open pail, owing to the greater difficulty of thoroughly cleaning it.

The daily weather forecasts issued by the Meteorological Office were examined throughout the week by many anxious farmers, and served to stimulate interest in the instruments and methods for making such forecasts. At the Climatological Station demonstrations were given of the measurement of temperature, rainfall, sunshine, etc., and of the use of balloons for determining the direction and velocity of the currents in the upper air. Of particular interest to the farmer were the charts showing the weather conditions favourable for large crops in the Eastern counties of England, and

diagrams showing the increased crops of grass, oats and clover after high rainfall in April and May, and the lower yield of wheat after heavy autumn rainfall.

The National Museum of Wales exhibited an interesting collection of old farm implements and tools, and the Cardiff Public Library a large collection of old books on agriculture and rural economy, horticulture, botany, surveying, and allied subjects.

There can be no doubt that the Agricultural Education Exhibition of the Show continues to fulfil a most useful function, bringing together for the benefit of farmers, technical workers and the public, some of the principal aspects of the work being conducted at the research stations and agricultural colleges. One of the most prominent features this year was the presence of very large numbers of deeply interested overseas soldier agriculturists.

THE following Note has been contributed by Mr. Castell Wrey and Mr. G. W. Olive, M.A. :—

**Report of Manurial
Trials carried out
on the Apethorpe
Estate during
1917-18.**

The experiments here described are being carried out on the Apethorpe Estate of Major Leonard Brassey, M.P., Northamptonshire. The estate comprises 2,800 acres of land (half arable) on heavy cold clay belonging to the Upper Estuarine series lying upon Great Oolite limestone. It is not highly fertile land, but much has been done to improve its productivity. The question of manurial treatment is naturally one of much importance, and it was decided, therefore, to conduct trials on the land. It was felt that these trials would have an added value in that the scheme would provide an opportunity for boys at the school (Oundle) to take part in co-operative work of a research nature.

The trials were framed to supply information upon such points as (1) the most economical manuring; (2) the most productive manuring; (3) the value to the land of manuring with such manures as sulphate of iron and sulpho potash.

There are a few features in regard to the applications of manure described in the following pages that need a word of explanation. Some of the applications might certainly be regarded as excessive. These applications, however, were intentionally so, in order to determine whether heavy outlay on manures is justifiable under the present conditions. Again,

an autumn dressing of soluble nitrogenous manures is unusual ; but the possibility of washing through is reduced for the reason that the average annual rainfall is low in this locality, viz., 22.5-25 in. Moreover, it is frequently the case that a relatively

TABLE I.

Plot	Manures.	Straw per Acre	Good Corn per Acre.	Tail Corn per Acre.	Total Corn per Acre.
		lb.	lb.	lb	bush. lb.
1	No Manure	2,421	1,093	122	20 15
2	10 tons Farmyard Manure ..	3,210	1,504	170	27 54
3	4 cwt. Basic Slag	3,509	1,459	117	26 7
4	10 tons Farmyard Manure ..	2,762	1,533	114	27 27
	4 cwt. Basic Slag	2,912	1,533	188	28 41
5	1 cwt. Sulphate of Ammonia ..	3,061	1,658½	144	30 2
	4 cwt. Basic Slag	2,935	1,685	130	30 15
6	2 cwt. Sulphate of Ammonia ..	3,144	1,725½	122	30 47
	4 cwt. Basic Slag	2,762	1,770	114	31 24
7	3 cwt. Sulphate of Ammonia*	2,952	1,749	112	31 1
8	10 cwt. Lime	2,480	1,453	120	26 13
9	4 cwt. Superphosphate	2,645	1,456	173	27 9
10	10 cwt. Lime	2,632	1,610	176	29 46
	4 cwt. Superphosphate	2,912	1,717	173	31 30
11	3 cwt. Sulphate of Ammonia*	3,584	1,792	162	32 34
12	10 cwt. Lime	2,240	1,469	125	26 34
13	4 cwt. Superphosphate	2,801	1,813	146	32 39
14	1 cwt. Sulpho Potash	2,986	1,744	112	30 56
15	3 cwt. Sulphate of Ammonia*	2,912	1,741	112	30 53
	1 cwt. Sulpho Potash	2,442	1,600	122	28 42
16	10 tons Farmyard Manure ..	2,240	1,482	165	27 27
17	4 cwt. Basic Slag	2,229	1,440	176	26 56
18	1 cwt. Sulphate of Iron	2,389	1,509	133	27 22
19	10 cwt. Lime	1,904	1,098	136	20 34
20	4 cwt. Superphosphate				
21	3 cwt. Sulphate of Ammonia*				
22	1 cwt. Sulpho Potash				
23	10 tons Farmyard Manure ..				
24	4 cwt. Basic Slag				

* Asterisk indicates both Autumn and Spring dressings for Sulphate of Ammonia and Nitrate of Soda in equal quantities, i.e. 1½ cwt. 14th November and 1½ cwt. 25th April. Without asterisk=Spring dressing only.

Dates of Application of Manures.—

Farmyard Manure, 23rd October.

Basic Slag, 1st November.

Sulphate of Ammonia, 14th November, 25th April.

Nitrate of Soda, 14th November, 25th April.

Superphosphate, 2nd November.

Lime, 18th December.

Sulpho Potash, 15th November.

Sulphate of Iron, 15th November.

small amount of rain falls during the later months of the year. For the year ending August, 1918, the rainfall was 17·8 in. Another reason suggested itself, namely, that considerable benefit might accrue from an autumnal nitrogenous dressing on a cold soil. It was originally intended to apply the lime earlier than December, but delay owing to war conditions prevented this. The same remark applies to farmyard manure.

The trials occupy about 15 acres on a slope facing south. A stream runs along the base of the slope, so that there is a good natural drainage. The plots are arranged in parallel strips running north and south, and are separated by smaller strips sown with peas. The size of each plot is $\frac{3}{8}$ ths of an acre. The soil does not vary over the whole area and, as mentioned above, is a heavy clay. The previous crop was clover, one crop of which was made into hay. The land was ploughed during the first days of September, 1917. The wheat, Red Standard, was sown 2 bush. to the acre on October 23rd and 24th.

Table I. records the dressings given, the dates of applications, and the yields obtained per acre.

The crops were cut on 6th and 7th August. A five-foot cut through the north end of all the plots was removed and ignored. This end suffered inequalities through inspection by visitors and through other causes. The crop from each plot was stacked separately.

The trials proved to be a fertile source of interesting experimental work, though much that would have been done in normal times was not done. A chemical analysis of the soil was made (Table II.).

The rainfall during the period of the trials, in inches, was as follows: 1917, September 2·12, October 2·91, November ·94, December ·60; 1918, January 1·65, February 1·02, March ·6, April 2·67, May 1·76, June ·35, July 2·3, August ·9, September 4·4.

Calculations based on the results of the trials are set out in Tables III. and IV. This gives in detail the cost of manuring and the value of the crop for each plot. It does not give the

TABLE II.—*Chemical Analysis of Soil.*

Moisture	3'41
Loss on Ignition	11'33
Nitrogen	258
Alumina Al_2O_3	7'90
Ferric Oxide Fe_2O_3	7'71
Magnesia MgO	a trace.
Lime CaO	2'37
Carbonates as $CaCO_3$	5'67
Potash K_2O —Total	851
Potash K_2O —Available	024
Phosphoric Acid P_2O_5 —Total	150
Phosphoric Acid P_2O_5 —Available	019

TABLE III.—*Details of Labour, Cost of Manures, Price of Corn and Straw used in Calculation of Table IV.*Area of each Plot = $\frac{1}{3}$ acre.(1) *Labour for Applying Manures.*

Plots.	Date.	Labour.	Cost.
2, 4, 9, 15, 19 .. {	Oct. 23	2 Men, 2 Horses. Carting Manure, 1 day	18s.
	Oct. 24	2 Men, 2 Horses. Carting Manure, 1 day	
3, 4, 5, 6, 7, 8, 9, 18, 19, 20, 12, 13, 14, 15. {	Oct. 25	1 Man. Spreading Manure, 1 day	4s.
	Nov. 1	2 Men. Sowing Artificials, $\frac{1}{2}$ day	6s.
7, 8, 9, 10, 14, 15, 17, 18, 19. {	Nov. 2	2 Men. Sowing Artificials, $\frac{1}{2}$ day	6s.
	Nov. 14	2 Men. Sowing Artificials, $\frac{1}{2}$ day	4s.
16, 17, 18, 19, 20, 21, 22, 23.	Nov. 15	2 Men. Sowing Artificials, $\frac{1}{2}$ day	4s.
11, 13, 14, 15, 21 ..	Dec. 18	1 Man, 1 Boy, 1 Horse. Sowing Lime, $\frac{1}{2}$ day	10s. 6d.
5, 6, 7, 8, 9, 10, 14, 15, 17, 18, 19.	Apl. 25	2 Men. Sowing Artificials, $\frac{1}{2}$ day	6s.

(2) *Cost of Manures.*

	Per ton.		
	£	s.	d.
Farmyard Manure	0	5	0
Basic Slag	3	18	0
Superphosphate	5	17	0
Sulphate of Ammonia	15	15	0
Nitrate of Soda	22	10	0
Lime	1	10	0
Sulpho Potash	5	0	6
Sulphate of Iron	9	0	0

(3) *Price of Corn and Straw.*

Good Corn	75s. 6d. per qr.
Tail Corn	67s. 6d. "
Straw	55s. per ton.

total cost of production in each case. To arrive at an estimate of the actual profit per acre it would be merely necessary to subtract a value representing the cost of production from the values of column 7 of Table IV. Some of the prices used in making these calculations are shown in Table III.

Conclusions.—1. All applications of manure gave a bigger yield than no manure.

2. Three cwt. of sulphate of ammonia + 1 cwt. sulpho potash gave the biggest yield of grain [Table I., Plot 17] and the biggest cash return [Table IV., Plot 17].

3. Large quantities of artificials in addition to farmyard manure gave big yields of corn and straw, but a big cash loss [Table I., Plots 9, 15, 19; Table IV., Plots 9, 15, 19].

4. Any form of available nitrogenous manure such as sulphate of ammonia or nitrate of soda gave a considerable increase in both grain and straw.

5. An autumn dressing of sulphate of ammonia had a marked beneficial influence on crop production.

6. Considered from the results of the first year, it was apparently a sounder investment to apply 3 cwt. of sulphate of ammonia than 10 tons of farmyard manure [Table IV., Plots 2, 10]. 3 cwt. of sulphate of ammonia gave a profit of £2 5s. 6d. more per acre than 10 tons farmyard manure.

7. Basic slag by itself was a profitable manure, by reason of the weight of straw produced [Table I., Plot 3; Table IV., Plot 3].

8. Superphosphate and lime together gave more grain but less straw than basic slag, but in the quantities as used (*i.e.*, 4 cwt. basic slag to 4 cwt. superphosphate and 10 tons lime) basic slag was more profitable [Table I., Plots 3, 13; Table IV., Plots 3, 13].

9. Four cwt. basic slag + 3 cwt. nitrate of soda gave a somewhat bigger yield of both grain and straw than 4 cwt. basic slag + 3 cwt. sulphate of ammonia [Table I., Plots 7, 8]. The higher price of nitrate of soda, however, made it less profitable to use [Table IV., Plots 7, 8].

10. Both sulphate of iron and sulpho potash had a beneficial effect on the production of grain, but not of straw.

11. Any single added substance, whether a recognised fertiliser or an outside substance, such as sulphate of iron, caused approximately the same increase in crop, but the addition of nitrogen gave further increase.

12. Plots 18 and 19 indicate that the effect is only that of sulphate of ammonia

TABLE IV.

Plot.	Cost of Application of Manures per acre. (1)	Cost of Manures per acre. (2)	Cost of Manuring per acre. (3)	Value of Good Wheat per acre. (4)	Value of Tail Wheat per acre. (5)	Value of Straw per acre. (6)	Value of Corn and Straw per acre. (7)	Value of Crop minus Cost of Manuring. (8)	Increase in Return [Shillings] per acre by Manuring. (9)	Loss or Gain by Manuring per acre [calculated from Column (9)]. (10)
I and 24, average	Shillings 0	Shillings 0	Shillings 0	Shillings 172.3	Shillings 18.1	Shillings 53.1	Shillings 243.5	Shillings 243.5	Shillings 0	—
2	21.3	50	71.3	236.6	23.9	78.7	339.2	267.9	+24.4	Gain of 1 4 6
3	27	15.6	18.3	228.1	16.5	86.2	330.8	312.5	+69.0	" 3 9 0
4	24.0	65.6	89.6	241.1	16.0	67.8	344.9	235.3	-8.2	Loss of 0 8 0
5	2.65	31.35	34.0	241.1	26.4	71.4	338.9	304.9	+61.4	Gain of 3 1 6
6	4.0	47.1	51.1	260.8	20.25	75.2	356.25	305.15	+61.65	" 3 1 6
7	5.3	62.85	68.15	265.1	18.3	72.1	355.5	287.35	+43.85	" 2 4 0
8	5.3	83.1	88.4	271.3	17.2	77.2	365.7	277.3	+33.8	" 1 14 0
9	26.5	112.85	139.35	278.4	16.0	67.8	362.2	222.85	-20.65	Loss of 1 0 6
10	2.65	47.25	49.9	275.1	15.75	71.5	362.35	312.45	+68.95	Gain of 3 9 0
11	5.3	15	20.3	228.6	16.9	60.9	306.4	286.1	+42.6	" 2 8 6
12	2.65	23.4	26.05	229.0	24.3	64.9	318.2	292.15	+48.65	" 2 13 0
13	7.95	38.4	46.35	233.3	24.75	64.6	342.65	296.3	+52.8	" 1 4 6
14	12.0	85.6	97.6	270.1	24.3	71.4	365.8	268.2	+24.7	Loss of 0 17 0
15	30.5	135.6	166.1	281.8	22.8	88.0	392.6	226.5	-17.0	Gain of 2 14 0
16	1.3	5	6.3	231.1	17.6	55.0	303.7	297.4	+53.9	" 3 16 0
17	4.0	52.25	56.25	235.2	20.5	70.25	375.95	319.7	+76.2	" 2 5 6
18	6.6	67.85	74.45	274.3	15.75	73.3	363.35	288.9	+45.4	Loss of 1 8 0
19	27.8	117.85	145.65	273.9	15.75	71.4	361.05	215.4	-28.1	Gain of 2 18 0
20	2.65	24.6	27.25	231.7	17.2	60.0	328.9	301.65	+58.15	" 1 17 0
21	6.6	24	30.6	233.1	23.2	55.0	311.3	280.7	+37.2	" 2 12 0
22	1.3	9	10.3	226.5	24.75	54.7	305.95	295.65	+52.15	" 2 14 6
23	2.65	14	16.65	237.4	18.75	58.7	314.8	298.15	+54.65	" 2 14 6

One point at least remains to be settled. The residual value of the various applications of manure must be determined. To obtain information in this direction the plots have been sown with barley in 1919 without the application of any manure whatsoever. It was intended to sow autumn wheat, but weather and labour difficulties have made this impossible.

Interesting botanical and chemical work also await completion; for example, a determination of the influence of the various manurial treatments upon the anatomical structure of the straw and the composition of the grain and straw.

In presenting the report upon these field trials gratitude must be expressed to Major Leonard Brassey, M.P., of Apethorpe Hall, Peterborough, and to Mr. F. W. Sanderson, Headmaster of Oundle School. The former provided the land, supplied labour, etc., financed the scheme of manuring, and showed every sympathy with the efforts of the writers; the latter gave generous support, enthusiasm, and stimulus, and by these means the trials were made possible.

THE importance to agriculture of Reformatory and Industrial Schools situated in rural districts consists (a) in the immediate supply of labour of a certain type that they afford to farmers in the neighbourhood (b) in the interest awakened as regards allotments, etc., in the case of those boys who do not take up an agricultural life; and (c) in the potential source of skilled agricultural workers that they form.

**Agricultural
Training in
Reformatory and
Industrial Schools.***

The first two considerations may be briefly dismissed—

(a) While it was in the interests of food production during the War that the labour of the boys should be so utilised, it cannot be pretended that the practice is permanently to the benefit of either the boys or the nation. The work leads nowhere; it is generally of a more or less unskilled character, such as hoeing, singling, weeding or planting, work for which low-grade labour of the casual type is often employed; and the fact that the boys may be hired out at less than the full local rate of wages for boys of the same age is a disadvantage rather than otherwise.

* Training in Farm and Garden Work in Reformatory and Industrial Schools, H.M. Stationery Office, 2d. net.

(b) In the case of boys who enter industrial employment from these schools, it is true that such farm training as they receive is not lost if they take up rural work later in life (and such training makes this easier) or if they combine allotment-holding or poultry-keeping with their ordinary occupation ; yet the maximum use is not being made of the training, and these boys would more properly be replaced at the schools by those for whom a career on the land is definitely intended.

It is in the possibility of their training skilled farm workers that the importance to agriculture of these schools chiefly lies. On an ordinary farm the boy picks up his knowledge and develops his skill as best he can in the ordinary course of the work ; he is looked upon as a worker, and only in rare cases as a person to be trained for future usefulness. It is not surprising that under this system a shortage of men capable of undertaking the more highly skilled operations of the farm has arisen and that complaints have been frequent of the lack of interest shown by the boys in their work.

Special facilities exist at these rural reformatory schools for giving such training, and it is with the view of producing " a continuous succession of intelligent young workers fully cognisant of the methods of scientific farming, with a thorough knowledge of labour-saving devices, ready and able to cope with new methods and to work on business-like lines " that the Home Office have been considering the reorganisation of the systems of training adopted, so that the utmost use might be made of these facilities.

The Report under notice contains an account by an Inspector of the Board of Education (Mr. J. O. Peet) on the present conditions of training at 12 schools visited, together with suggestions for their improvement from the point of view above-mentioned. The following is a list of the schools visited :—

<i>Reformatory Schools.</i>	<i>Acreage.</i>	<i>No. of Boys.</i>
Bradwall, Cheshire	32 ..	80
Calder Farm, Yorkshire ..	173 ..	140
Castle Howard, Yorkshire ..	100 ..	90
Fylde Farm, Lancashire	85 ..	130
Hardwicke, Gloucestershire	120 ..	92
Hertford, Hertfordshire	71 ..	132
Kerrison, Suffolk	170 ..	120
Little Mill, Monmouthshire ..	41 ..	70
St. William's, Yorkshire ..	270 ..	225
Stoke Farm, Worcestershire ..	100 ..	90
<i>Industrial Schools.</i>		
Church Farm, Hertfordshire ..	200 ..	90
Purbrook, Hampshire	17 ..	93

The Inspector's report recommends, broadly speaking, two kinds of courses : (a) the lighter work of market gardening and fruit-growing ; (b) the heavier operations of skilled farm work. The first course is suitable for industrial schools, where few boys remain beyond the age of 15 years and 3 months, and for the younger boys in the reformatory schools ; the skilled operations of general farming are only suitable for the older boys in the reformatory schools. There is much light work such as boys can do, and there are many skilled operations in which they can be instructed in market gardening and fruit culture ; propagation of fruit and flowers and the management of glasshouses and garden frames would be quite suitable. On the other hand, in reformatory schools, farm training in such directions as work with horses, management of live stock, stacking, thatching and hedging, can be carried to a stage at which it produces valuable skilled workers, able, as a result, to command a good wage immediately on leaving.

Suggestions are made by the Inspector with regard to the syllabuses in the subjects above mentioned. Further, since it is not possible, except on very large farms, for more than a small number of boys to secure the amount of practice in skilled farm operations which is desirable, it is suggested that a section of the boys might be trained as farm and garden workers with a special knowledge of machinery and repairs. Boys with this kind of training would be valuable farm workers and would find ready and comparatively well-paid employment on the larger farms.

In parenthesis it may be remarked that various " practical agricultural " subjects, such as gardening, poultry-keeping, bee-keeping, wood-work and metal-work, possess much merit as subjects of general education if properly handled, particularly for boys who are being trained as manual workers. There are, moreover, certain " general " subjects of great value to boys taking up an agricultural or horticultural career ; thus boys who rise to positions as head gardeners or as farm bailiffs or foremen will be required to measure areas, keep accounts and possibly to take levels, so that older boys should be taught simple surveying, levelling and accounts.

Lastly, with regard to teaching staffs, it appears that at present some reorganisation is necessary, as the schools are understaffed ; the teachers of general subjects have in the past not been chosen because of any knowledge of rural work or of sympathy with rural ideals (so that the schoolroom work is little influenced by the rural environment), and there is almost

entire want of collaboration and correlation between the schoolroom teacher and the workshop or outdoor instructor. The teacher is often uncertain of his ground, but looks down upon the instructor as an uneducated man, whilst the instructor views the teacher as an amateur. The solution lies, it is suggested, in obtaining teachers trained and interested in the special work of the school and (in many cases) in engaging better educated instructors.

THE Board have received the following note from Mr. A. W. Oldershaw, M.B.E., B.Sc., County Agricultural Organiser for East Suffolk.

**A Simple Method
of Making Silage.**

The writer has had under observation for some time a method of making silage practised by Mr. Wm. Makens, of Colney, Norwich. In place of a silo Mr. Makens uses a pit about 4 ft. deep, 25 yd. long and about 5 yd. wide. The sides have a slight slope, which prevents access of air and allows for shrinkage of the silage. The pit, when quite full, holds the produce of 50 acres of lucerne, or sufficient to keep 100 cows for 6 months.

After the lucerne has been cut it is carted to the pit without chaffing. To avoid any strong smell from the finished product the crop should lie a day or so before carting—this must, however, depend on the weather. If the crop is carted very green the smell is apt to be offensive, hence it is better to allow the crop to wilt. Five or 6 acres of lucerne are carted in a day. Carting is carried on for 2 days, the work then being left for 1 day and again proceeded with for a further 2 days. As regards the labour required, 2 men are wanted at the heap, 3 men to put the crop into rows in the field, 2 men to pitch and 1 man to load.

When the pit is being filled, the first few loads are tipped in at each end, to enable the horses to draw the succeeding loads toward the centre, as one would draw over a heap of farmyard manure. When the lucerne in the pit is level with the surrounding ground the loaded carts go over it, and as it gets higher horses walk about on it. Carting continues until the heap stands about 12 ft. above the level of the ground, or as high as it can be made without rendering it impossible



FIG. 1.—"Trench" Silo filled and in course of being rock-faced with earth. A small portion is seen unfinished.



FIG. 2.—Back View of Silo.



FIG. 3.—Sh. wing Staging used when earthing over the Silo.

for the horses to draw up the loads. The sides and ends are then roughly cut and squared and the whole is topped up and roofed with earth by hand like a mangold clamp (see Figs. 1-3). The pre-war cost of filling worked out at about 7s. per acre.

In addition to the pit described above, Mr. Makens has two rather smaller pits. He has successfully made silage in this way for about 30 years from lucerne, sainfoin, vetches and trifolium, all unchaffed. Only once has the method been a failure and this was, in Mr. Makens' opinion, due to carting the crop when it was too wet.

The writer thoroughly examined the silage made by this method, and has found it of excellent quality. The material, being unchaffed, is fed to the cattle from racks, like hay. When carefully carted over and covered up there is very little waste on the sides or top of the pit. This method of making silage appears to be so successful that, where it can conveniently be adopted, there seems to be very little justification for the erection of costly silos, particularly at the present time when the price of materials is so high.

On sandy soil, such as that farmed by Mr. Makens, the cost of excavating a pit of the type indicated is not great, and work can be done at slack times. The sandy nature of the soil, moreover, obviates the need for any special drainage system. If a silo of this "trench" type were made on heavy land, the site would have to be carefully chosen so that good drainage could be provided, to take away all surface and underground water. Probably such a trench might be made near a deep ditch, and pipe drains arranged to take away the water. It is possible, although not certain, that it might be an improvement to put a layer of concrete on the sides and floor of the trench.

Analyses of Silage made in Mr. Makens' "Trench" Silo.*

				<i>Lucerne.</i> <i>Per cent.</i>		<i>Trifolium.</i> <i>Per cent.</i>
Moisture	..	..	..	49·00	..	65·88
Oil	..	..	..	0·82	..	0·94
Albuminoids	..	..	..	8·62	..	4·69
Carbohydrates	..	..	..	18·74	..	13·36
Fibre	..	..	..	19·09	..	11·89
Ash	..	..	..	3·73	..	3·24
				<u>100·00</u>	..	<u>100·00</u>

* Carried out by the courtesy of Mr. G. S. Robertson, M.Sc., of Chelmsford.

A DECREE was promulgated on 25th April, 1919, which provided for the constitution of Departmental and Regional Chambers of Agriculture in France, and set out the lines along which they should work. The main provisions of the Decree are as follows :—

**Formation of
French Chambers
of Agriculture.**

Departmental Chambers of Agriculture.—The activities of each departmental chamber will be controlled by a council of 5 honorary members appointed by the General Council and the Director of Agricultural Services. Two of these members will be members of the General Council, the remainder representing the principal agricultural groups of the district. The council members must themselves have farmed land in the department for not less than 10 years or have occupied posts in agricultural associations for not less than 5 years.

The members of the council are elected for 5 years. At the beginning of each annual session one councillor retires and a fresh one is elected; members can, however, be re-elected. Two members of the council are appointed as delegates to the council of the regional agricultural chamber.

The staff of each departmental chamber will consist of a president and a secretary. The president must call a meeting at least once a quarter. In the event of a division he has the casting vote.

It is the duty of the council before 1st November to prepare their programme for the ensuing year in consultation with the local agricultural associations. This programme should comprise crop experiments, selection of seed, experiments with manures, sprays, etc., improvement of live stock, selection of breeding stock, experiments with feeding stuffs, veterinary science, vine culture, cider-making, butter, cheese, jam-making, etc. Every effort should be made to disseminate the information thus obtained.

The council must then prepare and forward to the regional chamber financial estimates based on the work which they propose to undertake. After examination by the regional chamber and the Council of General Agricultural Inspection the estimates are forwarded to the Minister of Agriculture for decision as to the Government grant to be paid.

The departmental chamber must forward a report each year through the regional chamber to the Minister on the work carried out and the results obtained.

Regional Chambers of Agriculture.—The Decree provides for the creation of a regional chamber in each agricultural division

in the country. Apart from the general inspector for agriculture of the region, the council of the regional chamber consists of two delegates from each departmental chamber. The members serve in an honorary capacity and their membership terminates when they retire from the departmental chambers. The official staff consists of a president, 2 vice-presidents and a secretary, who are appointed for 5 years and can be re-elected.

A meeting must be held at least twice annually to consider the proposals and expenditure of the departmental chambers. In formulating its own scheme, the regional chamber must have regard to the proposals of the departmental chambers and the general agricultural conditions within the district. The scheme must be submitted to the Minister before 15th December.

The regional chamber will make recommendations to the Minister with regard to the grants to be made by the State to the departmental chambers. An annual report is made to the Minister by the regional chamber on its own work and that of the departmental chambers.

A NOTE published in the issue of the *International Review of Agricultural Economics* for April, 1919, gives particulars of a new Code issued by the German Government on 30th January last intended to regulate conditions of labour on the land, to check the exodus from rural districts and to attract urban wage-earners to agriculture. The main provisions of the Agricultural Labourers' Code are as follows :—

**New Agricultural
Labourers' Code in
Germany.**

Hours of Labour.—The number of daily hours of labour is not to exceed, on an average, eight for four months of the year, ten for another four months and eleven for the remaining four months. Payment for overtime is at a special rate. The time spent in going and coming between the farm and the place of work is included in working hours, but not the interval for rest nor the time spent in baiting horses or oxen. In the summer half of the year at least two hours a day rest must be allowed.

Wages.—As a rule wages in cash must be paid by the week. Where payment is partly in kind the produce paid must be of the average quality of the year's crop and must be measured by the metric system. Payments in kind must be made quarterly in so far as the nature and use of the produce allow. Where the produce due as wages in kind cannot be delivered its value must be paid in cash, reckoned according to the official maximum producers' prices, or, failing such, according to the maximum prices obtaining in the nearest market.

Since dwelling accommodation, allotment and other allowances often form part of labourers' pay, they must, if they have been guaranteed by the employer as part of such pay and if they have no market value, have their monetary value determined and recorded in writing.

When contracts of service have been concluded for the period of a year the pay must be distributed evenly over the various seasons. Should there be a breach of a contract of service the deduction from wages by way of penalty must not exceed one-fourth of the cash wage due, and in the aggregate such deductions must not exceed fifteen times the local standard daily wage for common labour, as laid down in the National Insurance Code.

At least one-tenth of the local standard daily wage, as laid down in the National Insurance Code, plus a 50 per cent. bonus, must be taken as the hourly rate of payment for overtime. In estimating payment for overtime the time occupied in baiting and looking after cattle must be reckoned as overtime unless it be the local custom to include this work in the contract of service. Other urgent kinds of work done on Sundays and holidays must be paid for at the rate of double the daily wage locally current under the National Insurance Code.

Workers' Committees.—The new Code provides that a workers' committee shall be formed for each farm or other agricultural unit, and shall draw up working rules to be conspicuously posted within the farm.

Protection of Women Workers.—Women agricultural workers who have charge of a household must be released from work in time to allow them to return home an hour before the principal mealtime. They must be released from work on Christmas Eve, Easter Eve, and the day before Whit Sunday. If they have the care of a large household or if they board workers not belonging to their own family they must not be obliged to work, except in cases of necessity, to an extent which seriously interferes with the performance of their domestic duties.

Dwelling Accommodation.—House accommodation must be unexceptional from a moral and a sanitary point of view. In the case of a married couple it must be adequate, allowing for the number and sex of children. The dwellings of unmarried labourers must be durable, must admit of being locked up, and must be furnished at least with a table, bed, chair, lock-up cupboard, and washing accommodation.

Cancelling of Contracts of Service.—Violence, coarse insults, immoral incitements in the course of employment, obstinate refusal or neglect to fulfil duties, repeated irregularity in paying wages, bad food, insanitary housing, constitute sufficient grounds for the cancelling of a contract of service, but not political activity or agitation in connection with trade unions.

The Code also provides for safeguarding the interests of pensioners, especially disabled soldiers, for the prevention and settlement of labour disputes and for joint consultations between the employers' associations and the agricultural labourers' delegates.

Hay Supplies.—In reply to Sir A. Lister, the Under-Secretary of State for War stated that he was not aware that horses and cattle belonging to farmers were suffering from want of hay.

Parliamentary Replies to Questions affecting Agriculture. Any farmer who was not satisfied that sufficient hay had been left him for his own stock had a right of appeal under Army Council Order of the 30th July, 1918,* to the farm produce county committee of his county, and that committee had absolute discretion to decide the quantity that should be left him. Where a farmer's hay was held by the War Department, and delivery had not yet been taken, and the farmer, though he did not appeal under the Army Council Order referred to, now found that he had not sufficient for his own stock until the 1919 crop comes into use, he should apply to the district purchasing officer for a release. The latter officer referred such applications to the farm produce county committee, and they were granted if the committee so recommended. (3rd July, 1919.)

Hay and Straw.—In reply to Lieut-Colonel Weigall, the Under-Secretary of State for War stated that the restrictions contained in the Army Council Order of 30th July, 1918,* in so far as they related to straw, were cancelled by an Army Council Order which came into force on 1st February, 1919.† It was intended to control the 1918 hay crop only as long as stocks of this crop last. The Army Council did not propose to control 1919 hay or straw in any manner. He pointed out that in cases in which straw commandeered last year had never been delivered and is still occupying space in stackyards, that until the straw had been delivered farmers were receiving payment at the rate of 15 per cent. per annum over and above the price agreed to be paid them for it. As the bulk of the straw was not purchased in the later months of last year, and baling operations continue throughout the whole year, it was manifestly impossible to take delivery at any specified time. (2nd July, 1919.)

Milk Prices.—The Food Controller informed Mr. Hurd that the figures of milk production by counties obtained by the Travelling Milk Commission and published by the Food Ministry, to justify a differentiation against the four south-western counties, were based on the results of the Milk Census taken by the Ministry of Food for the weeks ended 2nd June, and 7th December, 1918, and that they represented the actual returns of all producers of milk in each county. The figures for the counties not already published would be given as an appendix to the Final Report of the Travelling Milk Commission, which would be issued shortly. (2nd July, 1919.)

The Food Controller also stated, on 3rd July, in reply to Lieut.-Colonel Herbert, that evidence was received by the Travelling Commission of Enquiry into the Cost of Milk Production to the effect that, owing to the earlier summer and milder autumn in the south-western counties, it was possible for cows to remain at pasture from 1st April to 1st November, whereas the grass season in other parts of England and Wales was often over by the end of July. The recommendation made by the Commission as to differential prices was based in part upon

* Printed in this *Journal*, September, 1918, p. 1747.

† See this *Journal*, February, 1919, p. 1376.

this evidence. He added that he was satisfied that there were no grounds for asking the Commission to review the evidence on the point raised. (3rd July, 1919).

Milk Control.—In reply to Lieut-Colonel Weigall, the Food Controller stated that the Government had decided not to institute any permanent measure of milk control involving the taking over of the wholesale milk trade. They had, however, decided that the powers exercised by the Ministry of Food should be continued, the chief of which were the powers to fix maximum prices in case of need; to regulate distribution in times of short supply; to license all dealers in milk; and to grade milk. In addition, local authorities would be empowered to undertake the supply of milk within their areas. An Interdepartmental Committee, consisting of representatives of the Ministry of Food, the Local Government Board, the Board of Agriculture, and the Scottish Office, had been appointed to agree upon such legal and administrative measures as might be necessary to make effective the powers referred to above. (2nd July, 1919.)

Flax Production.—It was stated in the House of Commons that the Board had contracted with farmers in Great Britain for the production of approximately 13,000 acres of flax in 1919. A reliable estimate of the purchase price of the crop was not yet available. (3rd July, 1919.)

Agricultural Research.—In reply to questions by Major Hurst and Major Nall, the Parliamentary Secretary to the Board stated that under the original scheme for agricultural research as sanctioned by the Development Commissioners the subject of entomology was allocated to the University of Manchester. In consequence, a staff was appointed, and up to 1918 annual Grants in aid of the work were made. At the same time research in plant pathology was instituted at the Royal Botanic Gardens, Kew.

In 1918 the Board came to the decision that all research in plant diseases, whether due to insects or to fungi, should be concentrated in one phytopathological institute, which should be located at Rothamsted, where also the Board's scientific advisory staff in the subject should be stationed. In pursuance of this plan, which the Board were convinced would be to the advantage of agriculture, it became necessary to transfer the Manchester University Staff, as well as a portion of the mycological staff at Kew, to Rothamsted. As, however, the University had provided special facilities for the study of entomology it was decided to offer an annual Grant of £1,000 to enable them to continue their work in entomology and also to take up mycological study.

The moneys for such purposes come from the Development Fund, and the approval of the Development Commissioners is necessary. This the Board are now applying for. (1st July, 1919.)

OFFICIAL NOTICES AND CIRCULARS.

N.B.—The Orders which may be mentioned in this section of the JOURNAL may usually be obtained at the price of 1d. each from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, and 28, Abingdon Street, London, S.W. 1; 37, Peter Street, Manchester, and 1, St. Andrew's Crescent, Cardiff.

IN order that potato growers in districts scheduled by the Board as areas infected with Wart Disease may make arrangements for their supply of seed potatoes required for planting in 1920, the Board of Agriculture call attention to the fact that any approved immune variety of potato may be planted next season. Not anticipating, however, that the supply of immune first earlies will be sufficient to meet the demand during 1920, the Board will issue to growers general licences authorising the planting in infected areas during 1920 of certain susceptible first earlies, providing the seed has been saved from the 1919 crop grown in the area.

Wart Disease : Potato-planting in Infected Areas in 1920.

The Board are also prepared to grant special licences to *bona-fide* market growers who may find it necessary to import fresh seed, subject to the condition that the licences will not apply to land on which Wart Disease is known to be present.

THE Food Controller has made an Order (No. 688), dated 6th June, 1919, amending the Butter Order, 1918, as amended,* by the deletion of the following Sub-clause of Clause 12 of the Principal Order, namely :—

Order amending the Butter Order, 1918.

“(b) All butter made, blended or collected by any blender holding a licence as such issued by or under the authority of the Food Controller.”

WITH reference to the article entitled “Seed Mixtures for Land affected by Clover Sickness,” which appeared in this *Journal* in March last, page 1497, and was issued as Food Production Leaflet No. 61, the Board wish to point out that Clover Sickness as dealt with therein referred only to the fungus disease of clover, *Sclerotinia Trifoliorum*, and it was not intended to suggest that the seed mixtures recommended should be used on land infested by eelworm, *Tylenchus devastatrix*.

Seed Mixtures for Land affected by Clover Sickness.

Striking testimony to the value of scientific research in agriculture is offered by the latest report to the Board from the University of Cambridge, where plant breeding has for some years past been carried on by arrangement with the Board. The new wheats, Fenman and Yeoman, produced at Cambridge and distributed by the Food Production Department of the Board, last season gave yields of 8 to 9 qr. per acre, and in two cases of 12 qr. per acre,

New Wheats.

* Orders Nos. 976 and 1334 of 1918, printed in this *Journal*, September, 1918, p. 759, and November, 1918, p. 1019. Clause 12 of the Principal Order was published on p. 760.

Yeoman is not equal to Red Fife for milling and baking, but this year's tests show that it is sufficiently strong to produce a good quality loaf without the addition of any imported wheat.

A CIRCULAR Letter was addressed to County Councils and Councils of County Boroughs in England and Wales by the Board on the 8th July, explaining the views which the Board hold with regard to the redemption, under present conditions, of land tax charged on properties acquired for the purpose of land settlement.

Redemption of Land Tax.

It is stated that the cost of redemption of land tax at the present time is 30 years' purchase on the annual charge, and if the Council raise a loan for the redemption money at the present rate of interest for loans, namely $5\frac{1}{2}$ per cent., the annual interest and sinking fund charges payable for 80 years on the redemption of a Land Tax of £1 will be £1 13s. 5d. It follows, therefore, that unless the assessment of the property is likely to be increased by as much as 67 per cent., the redemption of land tax at the present time would not appear to be a profitable transaction from the point of view of the Council.

The Board agree that where a Council propose to expend considerable sums of money on equipment and adaptation, or on the planting of fruit trees and bushes, as a result of which expenditure the assessment of the Council's property for land tax is practically certain to be raised to a figure at least 67 per cent. above the present assessment, the redemption of the land tax on the basis of the present assessment would be desirable, and in such a case the Board would be ready to approve redemption. They are of opinion, however, that the question of redemption should be decided on the merits of each individual case, and, for this reason, they would prefer that the matter should, as regards each scheme, be left over until the Council's proposals for adaptation, equipment, etc., of the property are settled.

THE Board of Agriculture have purchased three more estates for the purpose of establishing additional farm settlements for ex-service men. One of the estates, consisting of 1,520

Farm Settlements.

acres, is situated at Berwick St. James, Wiltshire, about 7 miles north-west of Salisbury, and 6 miles from the Board's farm settlement at Amesbury, and it includes the village of Berwick St. James. Another estate is near Wantage and comprises 1,065 acres. The third estate is in the strawberry-growing district of Hampshire, mid-way between Southampton and Portsmouth, and comprises about 1,355 acres. Vacant possession of all these estates will be obtained at Michaelmas next. Several smaller areas have also been acquired, bringing the total acreage held by the Board for settlements up to 16,770 acres, the number of settlements being 11.

As the result of tests carried out at the Imperial Institute, London, to determine the rancidity of palm kernel and other feeding cakes, the following conclusions were arrived at :—

Rancidity of Palm Kernel and other Cakes.

Palm kernels and palm kernel cake and meal contain a lipase, which in the presence of moisture and warmth acts upon the oil present, liberating fatty acids, of which the volatile members have a strong sweat-like odour, and a very small

amount of these acids is sufficient to impart to the cake a peculiar odour. This change does not occur if the cake is kept dry, a condition which is necessary to the preservation of all feeding cakes.

Freshly prepared palm kernel cake has a characterisitic smell which is probably due to a trace of these acids produced during manufacture.

Palm kernel cake does not decompose more readily than cotton seed, linseed and ground nut cakes, these latter developing more acidity under similar conditions. These cakes differ from palm kernel cake in not yielding volatile fatty acids on decomposition. Palm kernel cake has been kept for eighteen months and was at the end of the time in good fresh condition and showed no increase in acidity. The only precaution taken was to keep the cake dry. (*Journal of Agricultural Science*, April, 1919.)

AN Order (No. 762) dated 19th June, 1919, has been made by the Food Controller to the effect that :—

**The Seeds, Oils
and Fats
Order, 1919.**

1. (a) Until further notice a person shall not either on his own behalf or on behalf of any other person, buy or sell or otherwise deal in, or offer or attempt to buy or sell or otherwise deal in, any of the articles specified

in the Schedule hereto, whether situated within or without the United Kingdom, except under and in accordance with the terms of a licence issued by or under the authority of the Food Controller.

(b) The Food Controller may, from time to time, by notice, include any other article in the Schedule or exclude any article from the Schedule.

2. This Order shall not apply—

(a) To contracts in writing entered into before the 23rd June, 1919 ; or,

(b) To the purchase by or sale to any one purchaser of any particular article situated within the United Kingdom in quantities not exceeding in the aggregate 5 tons during any one calendar month ;

(c) The purchase or sale of any of the said articles purchased or sold expressly for cultivation.

3. All parties to the purchase or sale of any of the articles specified in the Schedule, shall require or disclose (as the case may be) all such information as may be necessary or required by such parties or by or under the authority of the Food Controller, for the purpose of satisfying them or him that the provisions of this Order have not been contravened, and shall make all such returns as to stocks, purchases, sales, payments, prices and dealings in or treatment of any of the articles specified in the Schedule as may from time to time be required by or under the authority of the Food Controller.

Schedule.

Copra, Cotton Seed, Ground Nuts, Palm Kernels, Linseed, Ccoanut Oil, Cotton Seed Oil, Ground Nut Oil, Palm Kernel Oil, Soya Oil, Premier Jus, Oleo Oil, Neutral Lard, Linseed Oil.

THE Food Controller has issued an Order (No. 795), dated 25th June, 1919, entitled the Milk (Summer Prices) Amendment Order, 1919, providing that the maximum prices of

The Milk (Summer Prices) Amendment Order, 1919.

milk produced in England and Wales, and sold wholesale by or on behalf of the producer, shall be increased by 4d. per imperial gal. during the month of July. The wholesale and retail maximum prices in England and Wales are correspondingly increased during this month.

The rise in price is in consequence of the increase in the cost of production of milk brought about by the recent drought which has been experienced throughout the country.

THE Food Controller has decided to continue during the present season the purchase of hard cheese for delivery to the Government "pool." All deliveries by the makers up to the 31st October, 1919, will be covered by this decision.

Cheese Prices.

Maximum first-hand prices for the months of June to September for Whole Milk Cheese manufactured in England and Wales were fixed as follows :—

Manufactured on and after the 1st June to the 30th June (inclusive) 1s. 5d. per lb. Manufactured on and after the 1st July to 31st July (inclusive) 2s. per lb. Manufactured on and after the 1st August to the 31st August (inclusive) 1s. 10d. per lb. Manufactured on and after the 1st September to the 30th September (inclusive) 2s. per lb.

The maximum first-hand price for whole milk cheese manufactured in England and Wales during July includes a special drought allowance of 4d. per lb.

Permits of Exemption.—It may be useful to point out that the validity of a current Permit of Exemption is not affected by the revision in the minimum rates of wages. It is, of

Agricultural Wages. course, open to a worker who holds a permit to apply to his County District Committee to have the wages specified in his Permit revised, should he desire to do so, in view of the alteration in the minimum rates of wages, and a District Wages Committee may review all current Permits on their own initiative.

Attention may be usefully called to the point that the provisions of the Corn Production Act, 1917, as to Permits of Exemption, apply to all classes of workers employed in agriculture of both sexes. That is to say, applications for such exemptions may be made to the District Wages Committee of the area, on the forms provided, for either male or female workers who are suffering from an infirmity or physical injury which renders them incapable of earning the minimum rate fixed by the Wages Board and applicable to their case.

Minimum Rates.—Correspondence on the subject of the Board's Order of May 16th,* varying the minimum and overtime rates for male workers of 18 and over throughout England and Wales, indicates the existence of fairly widespread misapprehension as to certain of the

* See this *Journal*, May, 1919, p. 210.

provisions of the Order. In the first place, it does not appear to be generally understood that in the counties of Hertfordshire, Middlesex, Kent, Northamptonshire, Salop, Surrey, Sussex and Wiltshire, in which the special rates for horsemen, stockmen, shepherds, etc., based on a week of "customary" hours, have been cancelled, all classes of male workers in these counties, irrespective of their particular occupation are now subject to the minimum rates fixed for ordinary labourers, and are entitled to be paid overtime rates for all employment on a Sunday, and for all employment on weekdays in excess of 54 hours in any week in summer and in excess of 48 hours in any week in winter.

Overtime Rates.—Another misconception which is common arises from the form of the provision with regard to the payment of overtime rates for all employment in excess of $6\frac{1}{2}$ hours on one weekday in each week, except time spent on such day by stockmen of any class in connection with the feeding and cleaning of stock. This provision is in addition to, and not in substitution of, the other definitions of overtime employment, and its effect is not, as appears to be imagined in some quarters, that no payment need be made at all for the work of feeding and cleaning, nor, as had been suggested, that under no circumstances shall feeding and cleaning work be paid for at the overtime rates. If a worker whose minimum rate, for example, is 36s. 6d. for a week of 54 hours, exceeds the 54 hours, he is entitled, under the ordinary definition of overtime employment, to overtime rates for all hours in excess of 54, irrespective of whether or not the extra hours are spent in connection with the feeding and cleaning of stock. It is only when a worker does not become entitled to overtime rates under the ordinary definition of overtime that the provision with regard to the weekly half-holiday becomes effective. For example, if a worker whose weekly minimum wage is based on a week of 54 hours did not work more than 54 hours in the aggregate on the six days (and so did not become entitled to any overtime payment under the ordinary definition of overtime) he would nevertheless be entitled to overtime payment for all hours in excess of $6\frac{1}{2}$ on one weekday in the week, unless such extra hours were spent only on feeding and cleaning stock. But, as stated above, the worker would be entitled to overtime payment for all hours in excess of 54, whatever the work. All employment on Sunday, including, of course, feeding and cleaning work, has to be paid for at overtime rates, except in the case of horsemen, shepherds, etc., in certain counties whose rates are fixed on the basis of customary hours, or as in the case of Anglesey and Carnarvon, and of Denbigh and Flint, a fixed number of hours, which include Sunday work. (*Wages Board Gazette*, 7th and 16th June, 1919.)

The Agricultural Wages Board at their meeting held on the 4th July, after considering the objections lodged to their proposals of the 4th June to fix special rates of wages for the

**Rates of Wages for
Harvest Workers
and Female Workers.**

corn harvest in certain areas, and the reports on the proposals made by the District Wages Committees concerned, decided to issue Orders fixing special harvest rates for the following areas :—Cambridgeshire, Cheshire, Derby, Devonshire, Dorset, Gloucester, Hereford, Lincolnshire, Nottinghamshire, Oxon, Somerset, Suffolk, Surrey, Wiltshire, Yorkshire, Anglesey and Carnarvon, Denbigh and Flint. Although the proposal for Cambridgeshire applied also

to Huntingdonshire and Bedfordshire, which form part of the area of the same District Wages Committee, the Board, in view of the objections received from those counties, decided not to fix any special corn harvest rates for Huntingdonshire and Bedfordshire, and consequently in these counties, as in all the other areas in England and Wales not specified above, the question of any extra payment for the corn harvest will be a matter for mutual agreement between employer and worker.

The Wages Board also considered the objections received to their proposals of the 3rd June to increase the ordinary minimum and overtime rates of wages of females workers of 18 years of age and over, together with the reports from the District Wages Committees on the proposal, and decided to make an Order to increase the rates in accordance with the proposal, the effect of which is that the minimum rates for female workers of 18 years of age and over in all areas in England and Wales, except Yorkshire and Cumberland and Westmorland, will in future be 6d. per hour, with overtime rates of 7½d. per hour for weekdays and 9d. for Sundays; in Yorkshire and Cumberland and Westmorland the minimum rate will be 7d. per hour, with overtime at 9d. per hour on weekdays and 10½d. an hour on Sundays.

On a report presented by Sir Henry Rew from the Committee on "Allowances" with regard to recommendations from District Wages Committees on the subject of certain revisions in the values allowed for board and lodging in part payment of minimum rates of wages, the Board decided that immediate effect be given to the decision at their previous meeting to increase the value for full board and lodging for female workers of 17 years of age and over in all areas in which it is at present less than 15s. a week, to that amount, with proportionate increases in the other items of board and lodging for such workers, and in all such items for female workers below 17 years of age. The Board also adopted the Allowances Committee's recommendations that the determinations of the Northumberland and Durham, Staffordshire, Surrey, Glamorgan and Monmouth, and Pembroke, Carmarthen and Cardigan District Wages Committees, for certain increases in the values of board and lodging for male workers, should be approved.

Kent.—An employer was prosecuted at Cranbrook, Kent, on 5th June, for failing to pay the minimum wage to a worker 16½ years of age, although the Orders of the Board had

Agricultural Wages: been brought to his notice. The defendant

Legal Proceedings. was fined £15 and ordered to pay £4 7s. costs, and the balance of arrears, amounting to £1 10s. 7½d. The bulk of the arrears had been paid, after the summons had been served, before the hearing of the case.

Warwick.—Proceedings were taken against an employer at Coleshill, Warwickshire, on 11th June, in respect of the under-payment of several of his workers. The under-payment continued after the matter had been brought to the employer's notice, and he refused to pay the arrears of wages. The defendant was fined £6 and ordered to pay 15 guineas costs and arrears of wages, amounting to £28 9s. on summonses in respect of three of the workers. The summonses in respect of three other workers were dismissed.

Sussex.—An employer in Sussex was summoned at Midhurst, on 12th June, in respect of the under-payment of a worker employed by him as a carter. An Inspector had visited in December, 1918, and had found two workers underpaid, and the case had been settled by the payment of arrears of wages by the employer. On a further visit by the Inspector the carter was found still to be underpaid. The defendant was convicted, fined £2, ordered to pay £3 8s. costs, and arrears of wages amounting to £4 15s. (*Wages Board Gazette*, 16th June, 1919.)

THE Board have made draft Regulations under Section 9 (9) of the Corn Production Act, 1917, fixing a time limit for claims for compensation under Part IV. of that Act as amended by the Corn Production (Amendment) Act, 1918.

Claims for Compensation under Corn Production Acts. The draft Regulations provide that a claim for compensation in respect of loss incurred in consequence of a cultivation Notice or Order, or the determination of a tenancy by or under an Order, under the Defence of the Realm Regulations, must be made not later than one year from the service of the Notice or date of the Order or not later than the 31st July, 1919, whichever date is the later. This limit is extended in the case of a claim by a person where some other person was in occupation of the land when the Notice was served or Order was made, and such claim may be made not later than two months after the termination of the occupation of the person who was then in occupation.

Claims for compensation for loss suffered by reason of possession of any land having been taken by the Board or the Agricultural Executive Committees under the Regulations relating to cultivation must be made not later than the 31st July, 1919, or the expiration of one year after the possession terminates, whichever date is the later.

Copies of the draft Regulations may be obtained at the Office of the Board, 72, Victoria Street, London, S.W. 1, and any objections to the draft Regulations should be notified to them before 2nd July, 1919.

IN reference to the Agricultural Costings Committee which has been set up by the Departments of Agriculture and the Ministry of

Agricultural Costings Committee: The Objects of the Committee.

Food to obtain permanent information as to the costs and results of farming (see this *Journal*, April, 1919, p. 106, and June, 1919, p. 344, it is felt that it is in the interests both of the producer and consumer that farmers should be encouraged to keep cost accounts in the future if a policy of encouraging home production is to be adopted; farmers realise that it is difficult for all the support which they would wish for to be given to the agricultural industry in the matter of prices, wages, and a progressive agricultural policy, unless statistical information is available as a foundation. The question of the costs of farm products is continually arising and must be the basis of future legislation and policy.

It is impossible to obtain and codify this fundamental information in such a way as to carry conviction to the producer himself and to the consumer unless the farmer will co-operate with the Agricultural Costings

Committee in furnishing the necessary cost data on which alone a sound basis for the future development of the agricultural industry can be arrived at.

The Committee proposes to assist farmers who already keep accounts in the difficult work of recording the costs and profits of farming operations generally, and of particular kinds of produce, for instance, meat, milk, cereals and potatoes ; so that detailed information as to costings may be obtained on an extensive scale.

The information so obtained will, it is hoped, be available for the use of the Committee's records of the costs of production, etc., and will be of great use in promoting the welfare of the industry generally and also to the farmer himself. The records will be collected and centralised so that the average costs for a given district or product may be ascertained and economic and statistical data of permanent value may be compiled. The farms by which costs data are provided will be denoted in the records of the Committee by a number or letter only. The information will be treated in the strictest confidence and will be available for the assistance of farmers generally, but only under the strictest anonymity.

The information which it is hoped to collect and analyse should be of practical value to the individual farmer. He will no longer be in ignorance of the actual results of the various departments of his farm ; he will be able to see which of his operations are remunerative, and to concentrate on those departments which pay him best ; his farming methods and system can be varied as far as is practicable and consistent with good husbandry ; he can compare his own costs of a particular crop or product with the average cost in the district and investigate the reason for any abnormal expenses in his own case.

In these and other ways the information should promote efficiency and economy, and augment the profit-earning capacity of the farm.

Data will be available which will facilitate the considerations of questions affecting wages. Further, should any question arise affecting the control of prices, etc., proper records of ascertained facts will be in existence. The farmer will have information which will facilitate the adjustment of income tax problems, and the production of proper accounts will in many cases improve credit where financial assistance is sought. There appears to be no question therefore that the industry will be in a stronger position with proper and proved statistics than without these as hitherto.

The Committee realises that success in the work will be dependent on the goodwill and co-operation of the farmers, and it will as far as possible assist in the work which it asks of them. certain records in addition to financial records will have to be kept by the farmers, *e.g.*, Time Records, Food Consumption Records and Manure Records in as simple a form as possible. The necessary tabulating and balancing will be assisted in by the Committee's staff.

While emphasis is laid on the subject of the recording of costs, there is another allied subject which the Committee proposes to encourage, *i.e.*, the keeping of accounts by farmers. The two subjects of costs and accounts are closely related—in fact the recording of costs is merely an extension of ordinary book-keeping. The Committee will endeavour to encourage farmers to keep proper books and will give advice and assistance in various ways.

THE President of the Board has appointed a Departmental Committee to arrange for the testing, adaptation and improvement of machines likely to prove of value to agriculture, to examine inventions and new devices, and to advise as to the further steps which should be taken to promote the development of agricultural machinery.

Departmental Committee on Agricultural Machinery and Implements.

The Committee consists of the following :—

Sir Douglas Newton, K.B.E.

(*Chairman*).

Mr. G. C. Baddon.

Mr. Thompson Close.

Major J. G. Merrison.

Captain B. J. Owen.

Mr. H. G. Richardson.

Professor R. S. Seton.

Mr. J. G. Stewart.

The Secretary of the Committee is Mr. V. E. Wilkins, Board of Agriculture, 72, Victoria Street, London, S.W. 1, to whom all communications should be addressed.

THE Meteorological Office will, as in past years, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of a registration fee of 1s. and the cost of the telegrams, computed at 9d. per day. The supply of forecasts will continue until 30th September. The forecasts are drawn up each week-day at 4.30 p.m., and refer to the probable weather during the 24 hours comprising the following civil day. If the meteorological conditions are sufficiently definite, a "further outlook" extending the period covered to two or three days will be added.

Harvest Weather Forecasts.

Notifications will also be issued in connection with the continuance or break up of spells of fine weather. For this service a fee of 6d. is charged for each telegram despatched, in addition to the Post Office charges for telegraphy. A minimum sum of 5s. against which the charges may be booked must be deposited with the Office.

Applications for the forecasts should be sent to the Director, Meteorological Office, South Kensington, London, S.W. 7, with a cheque or postal order payable to the Meteorological Committee, to cover the cost of the telegrams for the period during which the forecasts are to be sent.

THE Travelling Commission of Enquiry into the Cost of Production of Milk have recently issued an Interim Report dealing with the establishment of differential zones and the estimated cost of production of milk in the summer of 1919. The Report (Cmd. 205) is published by H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2; at the price of 1d. per copy.

Cost of Production of Milk.

It has been announced that the terms of reference to the Royal Commission on Agriculture are as follows :—

**Royal Commission on
Agriculture.**

“To inquire into the economic prospects of the agricultural industry in Great Britain, with special reference to the adjustment of a balance between the prices of agricultural commodities, the costs of production, the remuneration of labour, and hours of employment.”

The members of the Commission so far appointed are :—

Sir William Peat, F.C.A. (*Chairman*),
President Institute of Chartered
Accountants, 1906-7 and 1907-8.
Charles Douglas, C.B., D.Sc., Agricul-
tunist.

E. W. Langford, Agriculturist.

Henry Overman, O.B.E., Agricul-
tunist.

G. Rea, C.B.E., Agriculturist.

R. R. Robbins, Agriculturist.

W. Anker Simmons, C.B.E., Land
Agent.

Arthur W. Ashby, Agricultural
Statistician.

George Dallas, Divisional Organiser
of the Workers' Union.

Joseph F. Duncan, Secretary of the
Scottish Farm Servants' Union.

Thomas Prosser Jones, Welsh Repre-
sentative.

George Nicholls, late M.P. for North
Northants and ex-Mayor of Peter-
borough.

W. R. Smith, M.P., Member for Well-
ingborough Division, Northants,
Chairman of the National Agricul-
tural Labourers' Union.

R. B. Walker, Secretary of the
National Agricultural Labourers'
Union.

Sir William J. Ashley, M.A., Hon.
Ph.D., Vice-Principal of Birming-
ham University.

H. S. Cautley, K.C., M.P., Member
for East Grinstead.

Frederick E. Green, Author and
Journalist on Agricultural sub-
jects.

John M'D. Henderson, Barrister-at-
Law and Chartered Accountant.

R. V. Lennard, M.A., Lecturer in
Modern History, Wadham College,
Oxford.

E. H. Parker, Director of Barclay's
Bank, Cambridge.

Three names remain to be added. When the Commission is com-
plete it will, in addition to the Chairman, consist of 22 members, of whom
eight will be agriculturists and eight representatives of labour.

The Joint Secretaries of the Commission are :—

Mr. Alexander Goddard, C.B.E.,
Secretary of the Surveyors' Insti-
tution.

Mr. R. S. Langford, of the Board of
Agriculture and Fisheries; Joint
Secretary to the Central Agricul-
tural Advisory Council.

THE total number of outbreaks of Rabies confirmed is 222, namely,
101 in Devon, 27 in Cornwall, 65 in Glamorgan, 8 in Monmouth, 2 in
Gloucester, 7 in Middlesex, 8 in Surrey,
Rabies. 1 in London, 2 in Kent, and 1 in Berkshire.

MISCELLANEOUS NOTES.

ACCORDING to the *International Crop Report and Agricultural
Statistics* for June, 1919, published by the International Institute of
Agriculture, the condition of the cereal crops

**Notes on Crop
Prospects and Live
Stock Abroad.**

of the Northern Hemisphere on the 1st June
was as follows (100 being taken to represent
the average yield during the last 10 years) :—

Wheat.—Scotland 95, Ireland 100, Sweden 105,

Canada 98, United States, winter 118, spring 97, Tunis 60. *Rye*.—
Sweden 95, Canada 101. *Barley*.—Ireland 105, Sweden 100, Canada 95,
United States 101, Japan 100, Tunis 40. *Oats*.—Ireland 100, Sweden 97,
Canada 95, United States 104, Tunis 80.

The following estimates of the production of the crops in 1919 are given:—*Wheat*.—Spain 17,295,000 qr. against 16,959,000 qr. in 1918, an increase of 2 per cent.; United States, winter, 111,595,000 qr. against 69,788,000 qr. in 1918, an increase of 59.9 per cent., spring, 42,864,000 qr. against 44,819,000 qr. in 1918, a decrease of 4.4 per cent.; British India 34,556,000 qr. against 46,290,000 qr. in 1918, a decrease of 25.3 per cent.; Tunis 826,000 qr. against 1,056,000 qr. in 1918, a decrease of 21.7 per cent. *Rye*.—United States 12,480,000 qr. against 10,392,000 qr. in 1918, an increase of 20.1 per cent. *Barley*.—United States 24,233,000 qr. against 30,756,000 qr. in 1918, a decrease of 21.2 per cent.; Tunis 661,000 qr. against 1,102,000 qr., a decrease of 40 per cent. *Oats*.—United States 148,266,000 qr. against 157,736,000 qr., a decrease of 6 per cent.; Tunis 353,000 qr. against 396,000 qr., a decrease of 10.7 per cent.

France.—According to a report published by the Ministry of Agriculture the condition of the crops on 1st May was as follows (figures for May, 1918, in brackets):—Wheat, 63 (74); barley, 65 (72); and oats, 65 (72). (80=good, and 60=fairly good.) The areas under the crops are as follows (in acres and figures for 1918 in brackets)—Wheat, 11,774,190 (11,922,060); barley, 926,300 (1,193,380), and oats, 6,843,730 (7,224,280). (*London Grain, Seed and Oil Reporter*, 17th June, 1919.)

Spain.—The estimated yield of wheat in Spain in 1919 is given as 17,299,800 qr., or 2.0 per cent. above the 1918 yield. The area is estimated at 11,318,000 acres, or 10.6 per cent. more than last year. (*London Grain, Seed and Oil Reporter*, 27th June, 1919.)

United States.—The Crop Reporting Board of the United States Department of Agriculture give the following estimates of production based on the condition of the crops on 1st July (in bush., and final official returns for 1918 in brackets):—Winter wheat, 839,000,000 (558,449,000), spring wheat, 322,000,000 (358,651,000), maize, 2,815,000,000 (2,582,814,000); oats, 1,403,000,000 (1,538,359,000); barley, 231,000,000 (256,375,000); rye, 103,000,000 (89,103,000); and linseed 13,000,000 (14,657,000).

The average yield per acre compared with that of 1918 (in brackets) is as follows (in bush.):—Winter wheat, 17.1 (15.2); spring wheat, 14.3 (16.0); maize, 27.3 (24.0); oats, 33.1 (34.6); barley, 25.0 (26.5); rye, 15.6 (14.4); and linseed 7.1 (7.6).

The preliminary returns of the Board show the acreage of maize to be about 102,977,000 acres, a decrease of about 4.2 per cent. of the area last year, and of linseed about 1,851,000 acres, or a decrease of about 4.5 per cent. (*London Grain, Seed and Oil Reporter*, 10th July, 1919.)

Canada.—According to a bulletin issued by the Bureau of Statistics on the 17th June, the areas under the crops this year are as follows (in acres, and figures for 1918 in brackets):—All wheat, 16,959,000 (17,353,902); spring wheat, 16,160,750 (16,937,287); oats, 14,564,000 (14,700,000); barley, 3,036,240 (3,153,711); rye, 576,858 (555,294); peas, 208,250 (235,976); mixed grain, 877,240 (921,326); hay and clover, 10,472,700 (10,544,625); alfalfa, 192,480 (196,428); and

potatoes, 692,900 (735,192). The average condition of the crops on 31st May was as follows (condition on 31st May, 1918, in brackets):—Spring wheat, 98 (96); fall wheat, 101 (75); all wheat 98 (96); oats 95 (100); barley, 95 (98); rye, 101 (94); peas, 91 (101); mixed grain, 92 (102); hay and clover, 101 (99); alfalfa, 95 (97); and pasture, 102 (100). (*London Grain, Seed and Oil Reporter*, 1st July, 1919.)

Live Stock in the Netherlands.—According to the census of March, 1919, the numbers of live stock were as follows (the corresponding numbers in June, 1910, being shown in brackets):—Horses, 362,011 (327,377); cattle, 1,968,609 (2,026,943); sheep, 437,075 (889,036); pigs, 449,829 (1,259,844). (*International Crop Report and Agricultural Statistics*, June, 1919.)

Live Stock in Prussia.—The census figures of the 1st March, 1919, show that the numbers of cattle were 9,098,302 against 10,229,703 on the 1st March, 1918, and pigs 4,644,068 against 3,308,108 on the 1st March, 1918. (*International Crop Report and Agricultural Statistics*, June, 1919.)

THE dry weather reported during May as having been favourable for farm work continued during June, despite some showers towards the end of the month. The drought was,

**Agricultural
Conditions in England
and Wales
on 1st July.**

however, prolonged too long, and the crops have generally suffered considerably and are by no means so promising as on the 1st June. The cold winds at the end of the month have also retarded growth, and the crops are very backward. The effect has been most marked in the case of all spring-sown crops, especially the later-sown oats, which are often a failure, while the autumn-sown corn is generally satisfactory.

Of the three chief cereals, wheat is the best, but is still expected to be much below average. The best reports, on the whole, come from the east and south-west, although there the crop is probably quite 5 per cent. below average. Barley is not so good, and some of the worst reports come from the midlands, the extreme north and parts of Wales being apparently the best. Oats are a still poorer crop, as might be expected in such a droughty season, and are barely four-fifths of an average. Beans are the best of the pulse crops, though not up to average, while peas are poor, especially in Essex. All straw is, of course, everywhere very short.

Potatoes are very backward, and badly in need of rain, while some of the later-sown are not yet above ground. Throughout the country the yield is expected to be below the normal, but the great potato districts of Lincoln and Lancashire (as well as Wales) have rather better prospects than the rest of the country.

Turnips and swedes have suffered badly from the drought, and consequent attacks of fly; frequent re-sowings have been necessary. The very earliest-sown fields in some cases look fairly well, but the others are poor, and the seed has in many cases not yet sprouted. Large areas yet remain to be sown. Mangolds are poor and patchy everywhere, especially in the south, although there are a few promising fields.

The hay harvest started, in many cases, slightly earlier than usual, but the results have been much poorer than were indicated a month ago as possible, if the rain came in time. Most of the seeds' hay has been got in in the south, while the meadow hay was generally in process.

of cutting. Although the yield is very light, the weather was favourable, and the hay has generally been secured in quite good condition.

Although the dry and subsequent cold weather has greatly retarded the growth of hops, which are generally backward, reports concerning this crop are very generally favourable, both in the western area and in Kent. Aphid has been less prevalent than usual, although attacks were being noticed towards the end of the month, and washing was then general pretty well everywhere. It is expected that the yield will be quite up to the average.

Prospects for fruit are decidedly less favourable than a month ago. Strawberries and raspberries have proved, on the whole, to be distinctly under average, while currants will also be somewhat below; but gooseberries, though very variable, should be about average. Apples and pears have nearly an average appearance, but plums and cherries are disappointing.

The pastures have been very bare; live stock consequently are short of grass, and have only done fairly well during the month.

Labour, especially skilled, is still reported as very short; but there has been in many districts almost a sufficiency of temporary labourers for the light hay harvest.

Summarising the returns, it appears that, mainly as a result of the long drought, all the crops, except hops, show but poor prospects. Expressing an average crop by 100, the appearance of the crops on the 1st July indicated probable yields per acre shown by the following percentages:—Wheat, 91; barley, 84; oats, 80; beans, 93; peas, 90; potatoes, 90; mangolds, 80; seeds' hay, 80; meadow hay, 78; hops, 101.

The following local summaries give details regarding agricultural labour in the different districts of England and Wales:—

**Agricultural
Labour in
England and Wales
during June.**

Northumberland, Durham, Cumberland, and Westmorland.—Labour generally is sufficient for requirements, but casual labour for the hay harvest and turnip-hoeing is rather scarce.

Lancashire and Cheshire.—The supply of labour is variable. In some districts it is still deficient, but in others it has been more plentiful for haymaking and potato-lifting. There is a fair supply of Irish labour, which commands good wages.

Yorkshire.—In one or two districts the supply of labour has been sufficient for requirements, but generally there is a shortage both as regards skilled and casual labour.

Shropshire and Stafford.—The supply of labour is generally deficient, but owing to the lightness of the hay crops and the poorness of the root crops, less has been required than usual at this period of the year.

Derby, Nottingham, Leicester, and Rutland.—In some districts the supply of labour is about sufficient, but in most more men could be usefully employed; there is a fairly general shortage of skilled men, especially of horsemen and cattlemen.

Lincoln and Norfolk.—The supply of labour varies considerably in different districts. There is a general shortage of skilled labour, especially of horsemen and shepherds.

Suffolk, Cambridge, and Huntingdon.—The supply of labour has mostly been sufficient, but there is still a scarcity in a few districts.

Bedford, Northampton, and Warwick.—In many districts the supply of labour has been sufficient, but skilled men are still scarce in several parts.

Buckingham, Oxford, and Berkshire.—There is apparently sufficient temporary labour to meet the present needs, but there is still a shortage of skilled labour.

Worcester, Hereford, and Gloucester.—Conditions have improved, but there is still a shortage of skilled men in most districts.

Cornwall, Devon, and Somerset.—The supply of skilled labour is generally deficient. Temporary labour has met requirements in some districts, but in others is still short.

Dorset, Wiltshire, and Hampshire.—Labour is in most places sufficient, but a few reports indicate a deficiency.

Surrey, Kent, and Sussex.—In some districts the supply of labour has been equal to the demand owing to the light hay crop and small amount of hoeing done, but in many districts skilled men are scarce.

Essex, Hertford, and Middlesex.—In most districts the supply is still deficient, the shortage in some relating to all classes, but skilled men are everywhere scarce.

North Wales.—In some parts the supply of labour has been equal to the demand, but in most districts it has been insufficient, particularly in the case of skilled men.

Mid Wales.—The supply of labour is variable, in some districts sufficient, in others short.

South Wales.—The supply of labour is still short in most districts.

STATEMENT showing the Average Price of **British Corn**, per Quarter (Imperial Measure), for the Quarter ending Midsummer, 1919, pursuant to the Corn Returns Act, 1882.

<i>Wheat.</i>	<i>Barley</i>	<i>Oats</i>
s. d.	s. d.	s. d.
73 1	62 8	48 0

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of June, 1917, 1918, and 1919.

	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919.	1917	1918.	1919.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	79 9	74 8	73 2	66 2	52 9	64 9	55 4	—	53 1
Norwich ...	77 11	74 1	73 4	65 2	57 7	63 9	55 2	45 1	48 3
Peterborough	78 1	74 6	72 11	65 1	56 7	62 2	55 1	—	48 4
Lincoln ...	77 8	74 1	73 6	68 0	56 3	61 6	54 8	—	51 7
Doncaster ...	77 11	73 8	72 10	—	—	67 10	54 11	—	47 10
Salisbury ...	78 2	73 6	72 11	65 8	56 3	62 0	55 1	45 1	48 2

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1917, 1918 and 1919.

Weeks ended (in 1919).	WHEAT.						BARLEY.						OATS.					
	1917.		1918.		1919.		1917.		1918.		1919.		1917.		1918.		1919.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan. 4 ...	76	0	71	2	72	2	66	4	58	0	62	3	47	1	45	5	48	8
" 11 ...	75	8	71	2	72	6	65	7	58	2	62	5	47	2	46	9	49	8
" 18 ...	75	8	71	3	72	7	64	9	58	1	62	3	47	4	47	9	50	0
" 25 ...	75	10	71	1	72	7	64	5	58	7	61	10	47	8	48	2	49	6
Feb. 1 ...	75	10	71	2	72	8	64	0	58	10	62	4	47	3	50	2	49	7
" 8 ...	76	0	72	0	72	7	63	5	59	0	62	3	46	11	50	6	49	2
" 15 ...	76	3	72	3	72	8	63	8	58	11	62	5	47	3	52	0	49	0
" 22 ...	76	9	72	2	72	8	63	9	58	9	62	6	47	8	52	3	49	4
Mar. 1 ...	77	4	72	2	72	7	64	0	57	9	62	7	48	0	52	0	48	8
" 8 ...	78	0	72	3	72	6	63	7	58	5	62	7	48	7	52	2	48	6
" 15 ...	78	10	72	4	72	5	64	1	56	10	62	5	49	4	51	0	46	8
" 22 ...	80	3	72	3	72	7	65	6	56	9	62	1	50	4	50	3	46	4
" 29 ...	81	5	72	4	72	7	71	10	56	7	62	8	51	10	48	10	46	11
Apr. 5 ...	84	4	72	11	72	6	60	11	56	7	62	8	55	1	49	10	47	2
" 12 ...	85	2	73	3	73	0	71	10	56	6	62	9	57	2	47	2	47	1
" 19 ...	84	10	73	3	73	1	70	6	56	6	62	9	59	8	47	0	47	3
" 26 ...	81	1	73	3	73	1	69	5	56	10	62	9	58	6	46	8	48	1
May 3 ...	77	7	73	5	73	2	64	4	56	5	62	8	54	9	47	4	48	7
" 10 ...	78	0	73	5	73	2	64	11	56	6	63	1	55	2	47	6	47	5
" 17 ...	77	11	73	4	73	3	64	10	56	6	62	4	55	2	46	4	47	11
" 24 ...	78	0	73	3	73	2	64	9	56	6	62	7	54	11	47	8	47	11
" 31 ...	78	0	73	8	73	3	65	11	60	0	62	7	54	11	44	9	48	3
June 7 ...	78	0	73	11	73	2	67	7	59	2	62	6	55	0	45	5	47	10
" 14 ...	78	2	74	3	73	3	75	6	57	9	62	8	55	1	45	7	48	11
" 21 ...	78	1	74	4	73	3	75	0	58	5	62	8	55	2	47	8	48	7
" 28 ...	78	3	74	4	73	3	73	11	57	10	63	4	55	1	46	4	49	1
July 5 ...	78	1	74	4	73	4	69	5	61	7	62	4	55	2	46	10	49	0
" 12 ...	78	2	74	4			70	10	57	5			55	1	47	0		
" 19 ...	78	3	74	3			72	1	60	5			55	2	45	4		
" 26 ...	78	3	74	3			65	7	56	11			55	2	46	2		
Aug. 2 ...	78	2	74	3			73	6	57	1			55	0	45	10		
" 9 ...	78	4	74	7			76	1	57	7			55	0	46	3		
" 16 ...	78	7	74	2			68	11	61	4			55	6	55	11		
" 23 ...	76	7	74	8			70	7	62	6			54	7	56	9		
" 30 ...	72	1	74	8			60	4	60	1			49	0	57	11		
Sept. 6 ...	71	6	72	3			59	3	60	4			46	7	56	9		
" 13 ...	70	7	72	5			57	2	60	1			45	0	49	2		
" 20 ...	70	8	72	6			56	10	60	4			45	8	49	11		
" 27 ...	70	6	72	7			58	5	60	3			44	7	50	3		
Oct. 4 ...	70	8	72	8			57	9	60	3			44	9	50	9		
" 11 ...	71	0	72	6			58	5	60	3			44	5	51	6		
" 18 ...	70	8	72	7			59	3	60	3			44	1	50	9		
" 25 ...	70	10	72	5			60	1	60	3			43	0	50	5		
Nov. 1 ...	70	4	72	4			59	11	60	3			42	4	50	8		
" 8 ...	70	3	72	4			60	2	60	3			42	11	49	11		
" 15 ...	70	3	72	5			60	2	60	3			43	0	49	10		
" 22 ...	70	2	72	4			59	9	60	10			43	1	51	1		
" 29 ...	70	2	72	3			59	3	62	2			44	6	50	4		
Dec. 6 ...	70	7	72	4			58	7	62	5			43	5	51	4		
" 13 ...	71	2	72	3			58	0	62	7			43	6	51	4		
" 20 ...	71	1	72	4			57	7	62	3			44	2	50	5		
" 27 ...	71	1	72	3			57	7	62	3			44	10	50	6		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in June and May, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	JUNE.		MAY.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.
FAT STOCK :—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Cattle :—				
Polled Scots	84 10	80 0	85 9	80 5
Herefords	85 2	80 0	85 8	79 11
Shorthorns	84 11	79 11	85 1	79 10
Devons	85 0	80 0	85 2	80 0
Welsh Runts	84 6	80 0	85 3	78 0
Fat Cows	79 11	71 10	79 11	71 10
	First Quality. per lb.*	Second Quality. per lb.*	First Quality. per lb.*	Second Quality. per lb.*
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
Veal Calves	20	17½	10½	9½
Sheep :—				
Downs	14½	14½	14½	14½
Longwools	14½	14½	14½	14½
Cheviots	14½	14½	14½	14½
Blackfaced	14½	14½	14½	14½
Welsh	14½	14½	14½	14½
Cross-breds	14½	14½	14½	14½
	per score. live weight.	per score. live weight.	per score. live weight.	per score. live weight.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Pigs :—				
Bacon Pigs	21 0	21 0	21 0	21 0
Porkers	21 0	21 0	21 0	21 0
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>
Shorthorn—In Milk ...	50 11	37 4	50 4	37 10
—Calvers	46 11	35 9	45 4	35 6
Other Breeds—In Milk ...	40 2	30 11	40 6	32 0
—Calvers	40 0	—	—	—
Calves for Rearing	4 7	3 6	3 13	2 13
Store Cattle :—				
Shorthorns—Yearlings ...	17 7	14 3	17 11	14 7
—Two-year-olds ..	27 17	22 14	28 6	23 2
—Three-year-olds ...	37 7	32 15	39 1	33 1
Herefords—Two-year-olds...	28 0	27 12	31 2	25 0
Devons—	29 0	24 13	30 9	25 12
Welsh Runts—	27 15	19 5	28 7	22 10
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Downs or Longwools ...	83 3	70 5	87 1	70 3
Store Pigs :—				
8 to 12 weeks old	65 3	49 8	65 2	48 2
12 to 16 " "	102 0	82 0	98 5	79 7

* Estimated carcass weight.

NOTE.—The prices per lb. for sheep do not include the value of the skins or pelts, which during June made prices equivalent to an additional 1½d. per lb. of the carcass weight for Downs, Blackfaced and Cross-breds, and 1½d. for Longwools, Cheviots, and Welsh, and during May, 1½d. per lb. for Downs, Cheviots and Cross-breds, and 2d. for Longwools, Blackfaced and Welsh.

In addition to the price quoted above for sheep per lb., sellers were entitled, under the Live Stock (Sales) Order, 1918, to charge an extra amount ranging from 4s. to 13s. 4d. per head during June, and 5s. to 16s. 8d. during May according to the weight of the sheep.

**AVERAGE PRICES of PROVISIONS, POTATOES and HAY at
certain MARKETS in ENGLAND in June, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	—	—	—	—	27 6	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	—	—	—	—	—	—
„ Factory	—	—	—	—	—	—
Imported (Controlled)	252 0	—	252 0	—	252 0	—
CHEESE :—						
British—						
Cheddar	144 6	—	—	—	144 6	—
Cheshire	—	—	120 lb. 155 0	—	120 lb. 155 0	—
Canadian	144 6	—	per cwt. 144 6	—	per cwt. 144 6	—
BACON :—						
Irish (Green)	195 6	—	195 6	—	195 6	—
Canadian (Green sides)	191 0	—	192 6	189 0	194 0	190 0
HAMS :—						
York (Dried or Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green) (long cut)	184 0	—	188 6	186 0	190 6	187 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	35 7	33 1
Irish	30 7	—	29 6	27 9	31 3	29 3
Danish	—	—	—	—	33 6	30 9
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Arran Chief	195 0	182 6	—	175 0	172 6	—
Edward VII.	230 0	220 0	185 0	165 0	192 6	—
Up-to-Date	230 0	200 0	166 6	151 6	—	—
HAY :—						
Clover	—	—	—	—	—	—
Meadow	—	—	—	—	—	—

**AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in June, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.				Quality.	Birming- ham.	Leeds.	Liver- pool.	London.	Man- chester.
					per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
					s. d.	s. d.	s. d.	s. d.	s. d.
BEEF:—									
English	...	...	...	1st	119 0	119 0	—	119 0	119 0
				2nd	119 0	119 0	—	119 0	119 0
Cow and Bull	...	...	...	1st	119 0	119 0	119 0	119 0	119 0
				2nd	119 0	119 0	100 6	105 0	100 6
Irish: Port Killed	...	...	...	1st	—	—	119 0	119 0	119 0
				2nd	—	—	119 0	119 0	119 0
Argentine Frozen—									
Hind Quarters	...	...	...	1st	117 0	118 0	118 0	118 0	118 0
Fore "	...	...	...	1st	83 6	83 0	83 0	83 0	83 0
American Frozen—									
Hind Quarters	...	...	...	1st	113 0	115 6	115 6	115 6	115 6
Fore "	...	...	...	1st	83 0	80 6	80 6	80 6	80 6
Canadian Frozen—									
Hind Quarters	...	...	...	1st	113 0	115 6	115 6	115 6	114 6
Fore "	...	...	...	1st	83 0	80 6	80 6	80 6	81 6
VEAL:—									
British	...	...	...	1st	139 6	140 0	—	167 6	147 0
				2nd	108 6	119 0	—	132 0	122 0
Foreign	...	...	...	1st	—	—	—	—	—
MUTTON:—									
Scotch	...	...	...	1st	126 0	126 0	126 0	126 0	126 0
				2nd	126 0	126 0	126 0	126 0	126 0
English	...	...	...	1st	126 0	126 0	—	126 0	126 0
				2nd	126 0	126 0	—	126 0	126 0
Irish: Port Killed	...	...	...	1st	—	—	126 0	—	126 0
				2nd	—	—	126 0	—	126 0
Argentine Frozen	...	...	...	1st	107 6	107 6	107 6	107 6	107 6
New Zealand "	...	...	...	1st	—	—	—	107 6	107 6
Australian "	...	...	...	1st	—	—	—	107 6	107 6
LAMB:—									
British	...	...	...	1st	126 0	126 0	—	—	126 0
				2nd	126 0	126 0	—	—	126 0
New Zealand	...	...	...	1st	107 6	107 6	107 6	107 6	107 6
Australian...	...	...	...	1st	—	—	—	—	107 6
Argentine...	...	...	...	1st	107 6	107 6	107 6	107 6	107 6
PORK:—									
British	...	...	...	1st	—	149 6	149 6	149 6	149 6
				2nd	—	—	—	—	149 6
Frozen	...	...	...	1st	—	—	—	—	—

DISEASES OF ANIMALS ACTS 1894 to 1914.

NUMBER OF OUTBREAKS, [and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	JUNE.		SIX MONTHS ENDED JUNE.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	12	11	100	143
Animals attacked	13	13	132	161
Foot-and-Mouth Disease :—				
Outbreaks	—	—	19	—
Animals attacked	—	—	154	—
Glanders (including Farcy) :—				
Outbreaks	2	4	14	19
Animals attacked	2	13	40	55
Parasitic Mange :—				
Outbreaks	397	329	3,479	2,990
Animals attacked	780	585	6,849	5,703
Rabies :—				
Number of cases	14	—	115	—
„ „ Dogs affected	14	—	112	—
„ „ other animals affected	—	—	3	—
Sheep-scab :—				
Outbreaks	1	9	213	244
Swine Fever :—				
Outbreaks	295	186	1,014	719
Swine slaughtered as diseased or exposed to infection	158	83	445	260

IRELAND.

(From the Returns of the Department of Agriculture and Technical
Instruction for Ireland.)

DISEASE.	TWO WEEKS ENDED 14TH JUNE.		24 WEEKS ENDED 14TH JUNE.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	1
Glanders (including Farcy) :—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Parasitic Mange :—				
Outbreaks	13	5	87	73
Sheep-scab :—				
Outbreaks	2	6	152	170
Swine Fever :—				
Outbreaks	—	2	18	9
Swine slaughtered as diseased or exposed to infection	1	2	60	29

The Weather in England during June.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.	
	*F.	*F.	In.	Mm.*	Mm.*		Hours.	Hours.
<i>Week ending 7th June :</i>								
England, N.E. ...	57.0	+3.2	0.16	4	— 7	3	6.5	+0.4
England, E. ...	56.3	+0.3	0.08	2	— 11	1	6.5	— 0.2
Midland Counties ...	59.0	+3.0	0.11	3	— 11	2	6.2	+0.1
England, S.E. ...	57.7	+0.9	0.05	1	— 13	1	6.6	— 0.4
England, N.W. ...	57.7	+2.7	0.21	5	— 5	2	6.6	+0.3
England, S.W. ...	57.7	+1.6	0.08	2	— 12	1	6.8	0.0
English Channel ...	57.7	+0.9	0.00	0	— 13	0	7.2	— 0.1
<i>Week ending 14th June :</i>								
England, N.E. ...	59.1	+4.8	0.12	3	— 7	2	9.9	+3.5
England, E. ...	60.4	+4.6	0.08	2	— 10	1	10.5	+3.8
Midland Counties ...	60.0	+4.3	0.29	7	— 3	2	10.0	+3.6
England, S.E. ...	59.7	+3.0	0.05	1	— 9	1	9.4	+2.3
England, N.W. ...	57.9	+2.3	0.42	11	— 1	3	9.5	+2.4
England, S.W. ...	57.7	+1.6	0.45	11	— 3	2	9.3	+2.1
English Channel ...	59.1	+2.1	0.01	0	— 8	1	8.2	— 0.1
<i>Week ending 21st June :</i>								
England, N.E. ...	58.1	+1.9	0.16	4	— 10	3	6.3	+0.4
England, E. ...	59.3	+1.4	0.65	17	+ 6	2	9.8	+3.2
Midland Counties ...	58.1	+0.7	0.27	7	— 7	3	7.4	+1.6
England, S.E. ...	58.2	0.0	0.58	15	+ 4	3	9.7	+2.7
England, N.W. ...	55.2	— 1.4	0.48	12	— 6	4	6.5	+0.8
England, S.W. ...	55.7	— 1.2	0.37	9	— 5	3	6.7	+0.6
English Channel ...	57.9	— 0.3	0.36	9	— 3	3	8.6	+1.1
<i>Week ending 28th June :</i>								
England, N.E. ...	52.7	— 5.0	0.34	9	— 7	5	3.4	— 3.0
England, E. ...	53.4	— 6.3	0.21	6	— 5	3	3.6	— 3.7
Midland Counties ...	53.7	5.4	0.20	5	— 9	4	4.0	— 2.5
England, S.E. ...	55.0	— 5.0	0.08	2	— 8	2	4.8	— 7.1
England, N.W. ...	53.0	— 4.8	0.32	8	— 0	4	4.2	— 2.1
England, S.W. ...	54.5	— 3.9	0.28	7	— 8	3	5.3	— 1.8
English Channel ...	55.5	— 3.9	0.30	8	— 1	2	6.7	— 1.9

1 inch = 25.4 millimetres.

THE JOURNAL OF THE BOARD OF AGRICULTURE

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EDITORIAL NOTES.

THE English farmer has been reproached in the past with his unwillingness to take to new and unfamiliar feeding stuffs. When supplies of the commoner

Fish Meal.

feeding stuffs were plentiful this attitude was perhaps not open to any very serious criticism. With a pronounced falling off in the imports of concentrated feeding stuffs during the War, however, any hesitation to make use of whatever was available was bound to be costly, since farmers were compelled to depend less on the concentrated feeding stuffs to which they had been accustomed and rely more on ordinary roots and fodders, or else to use more extensively certain home products which they had previously either entirely neglected or used only to a small extent. Now that the early prejudices have been dispelled some of these home products promise to play a more important part in the feeding of live stock.

Of these new and hitherto little-used feeding stuffs, fish meal is perhaps the best known. Before the War the manufacture of fish meal had attained the dimensions of a considerable industry at the larger fishing ports in the country, but, although its use as a food for pigs and poultry was steadily increasing, it was not very popular with farmers, and by far the greater proportion manufactured was exported to the Continent. It lies entirely with British farmers to decide whether that export trade will be resumed, or whether, as it is hoped, they themselves will consume the supplies of fish meal that are made in the country. Fish meal is no longer an untried or doubtful feeding stuff, and its good qualities are now familiar to a rapidly-increasing number of farmers who find it a valuable food for all classes of live stock. Its possibilities as a feeding stuff are discussed in an instructive and interesting article by Dr. Crowther at p. 480.

* * * * *

A POINT which is deserving of the closest attention of farmers is the possible use of new and labour-saving machinery and implements. The enormous saving which may be effected by rapid cultivation, and particularly by rapid harvesting of crops in suitable weather, is now coming to be clearly recognised by the majority. Farmers now happily recognise the undoubted fact that in modern farming labour-saving machinery of the highest grade is as absolutely essential as skilled workmen, and agricultural societies might well aid in impressing this point on the few who are as yet unconvinced. The need for improvements is so strongly felt, both publicly and officially, that a Departmental Committee on agricultural machinery and implements has been appointed by the President of the Board (see this *Journal*, July, 1919, p. 465). Arrangements have also been made to publish in this *Journal* a series of articles dealing with the various classes of machinery, the first article appearing in this issue, p. 484.

THE article on the work of the Rothamsted Agricultural Experimental Station from 1914 to 1919 at p. 497 will be read with interest as showing the steps which are being taken, both by field investigation and laboratory experiment, to add to our knowledge of the best methods of increasing crop production. The exigencies of war have stimulated scientific inquiry in all branches of industry to an extent which would hardly have been realised in the less necessitous times of peace, and the threatened shortage of foodstuffs made this especially so in the case of agriculture. It was natural that Rothamsted, the home of agricultural research in this country, should take a leading part in the work of investigation. The scarcity of fertilisers brought about by the reduction of our imports and the supreme requirements of munitions led to experiments designed to test the merits of new fertilisers or to derive the greatest benefit from the reduced supplies of those of established worth. The workers at Rothamsted have been busy also in devising means of combating insect and fungus pests and weeds and in the control of soil organisms.

Agriculture is essentially an industry in which energy and experience will prove the main factors for success—but experience should include experiment.

Scientific and up-to-date farmers recognise the value of experiment and research directed to the solution of agricultural problems. Some farmers, however, are still disposed to regard theory as being inapplicable to practical operations : it is hoped that any such who may read the account of what has been achieved at Rothamsted during the War will realise that as great and even greater services will in future be rendered to agriculture and to them. The best results can only be obtained by combining practical experience of farm work with a knowledge of the new facts which science has revealed.

* * * * *

THE adjustment of farming practice to the rapidly-changing conditions which are the aftermath of the War offers many problems of great complexity. During the war period farmers frequently had to face novel and difficult situations, but the main policy kept in view, that is, the production of the maximum amount of food for the country, even at the expense of the individual, was always clear. Although the interests of the country must necessarily still be kept in the foreground, farmers must now formulate their future farming policy with more regard to the play of ordinary economic factors. In doing this they will not always obtain correct guidance from pre-war practice, and it may often be necessary to work on entirely new lines.

**Farming on the
Soiling System.**

In no branch of farming is the problem more difficult than in the feeding of dairy stock. Arable land offers opportunities for the production of food for dairy cows in an intensive fashion that will enable a much greater number to be kept on a particular acreage of land. Though little followed in this country where grass holdings have been cheap, the Soiling System is widely practised in many foreign countries. During the past few years some very interesting experiments have been carried out at the Harper Adams Agricultural College with a view to showing the possibilities of the system as applied to conditions in this country. A full account of these experiments will be found in the article, "Farming on the Soiling System," which appears in this issue, p. 507.

FISH MEAL AS A FOOD FOR LIVE STOCK.

CHAS. CROWTHER, M.A., Ph.D.,

Director of Research, Olympia Agricultural Company, Limited.

THE greatly reduced imports of concentrated feeding-stuffs during the War forcibly directed attention to the fact that there is much home-produced material suitable for feeding purposes which in pre-war days was either entirely neglected, or used only to a very small extent by owners of live stock in this country. This applies particularly to fish meal, the production of which before the War had attained the dimensions of a considerable industry at the larger fishing ports of the United Kingdom. It is estimated that in 1913, out of a total production of 40,000 tons of fish meal, 30,000 tons were exported to the Continent, mainly to Germany, where it found a ready sale. In this country the use of fish meal for pigs and poultry has been steadily increasing in recent years, but it has been little used in the feeding of other classes of live stock, and the total demand is still far below what the potential supply will be when the fishing industry is fully rehabilitated. There is grave risk, therefore, that manufacturers may be obliged once more to resume the export trade. This contingency can only be avoided by an extended use of fish meal by British farmers, as a food not merely for pigs and poultry, but also for other classes of live stock.

Composition of Fish Meal.—In purchasing fish meal it is necessary to distinguish carefully between the fish meal manufactured for use as a feeding-stuff and the inferior article, commonly sold as "fish guano," which is intended for manure. The raw material from which the former is made consists of the fresh offal (heads, etc.) removed from the fish at the ports before despatch, together with whole fish rejected as unfit for human consumption or rendered unsaleable owing to an excessive supply. The best manufacturers reject herrings for making fish meal on the grounds that they contain too much oil, and the herring residue received from the curers contains too much salt. Where the object of the manufacturer is to produce a "fish guano," no such discrimination is exercised, as no question of wholesomeness arises, the one object being to secure a product which contains sufficient nitrogen and phosphate to form a satisfactory fertiliser.

When purchasing fish meal for feeding purposes it is advisable, therefore, to ask for special guarantees, such as are outlined below.

In the manufacture of fish meal the raw material is first thoroughly steamed and a portion of the oil removed, and the residue then completely dried at a high temperature, and ground to meal.

The composition of fish meal is variable, but the following summary of nine analyses made in recent years gives an indication of its general character :—

					Range of Variation.	Average.
					Per cent.	Per cent.
Moisture	..	..	..	..	7.7 to 18.1	12.9
Albuminoids (Protein)	..	..	..	..	51.1 „ 63.1	—
Oil	..	..	..	..	1.3 „ 6.7	3.7
Mineral Salts (Ash)	..	..	..	..	20.8 „ 28.0	24.9
Including Phosphate of Lime	..	..	..	..	16.6 „ 20.6	18.8
„ Salt	..	..	..	..	0.6 „ 5.3	2.2
Carbohydrates, Fibre, etc.	..	..	..	..	0.3 „ 4.2	1.9

It will be seen that the chief characteristics of the composition of fish meal are its richness in albuminoids and phosphate of lime, ingredients which may be expected to give it a special value for the production of flesh and bone. It contains a very small proportion of carbohydrates, however, and hence *can only exercise its full value effectively when used along with other feeding-stuffs which supply an abundance of this constituent*, such as the home-grown fodders, roots and grain foods, or the more starchy purchased feeding-stuffs such as maize and milling offals. The complaints that have frequently been made that fish meal taints the flavour of the carcass are almost certainly due to neglect of this precaution—fish meal having formed too large a proportion of the diet in these cases. As a rough, general rule for practical feeding purposes, it may be suggested that *fish meal should not form more than about one-eighth of the total dry food consumed*. Practical experience in pig-feeding has demonstrated that, if this rule be adhered to, pork or bacon of excellent quality can be produced without the slightest fishy taint, provided, of course, that the fish meal is of good quality, and not too rich in fish oil.

Standard Quality Fish Meal.—In order to secure these latter essentials special guarantees should be demanded in the purchase of fish meal. To meet this demand, the Association of Fish Meal, Fish Guano and Fish Oil Manufacturers, comprising nearly all the manufacturers in Great Britain, have agreed to produce a meal from white fish only (*i.e.*, without

herrings or other unsuitable material), to be sold as "White Fish Meal," and to conform with the following limits as to composition :—

Albuminoids	..	..	..	Not less than 55 per cent.
Phosphate of Lime	..	..	" "	16 "
Oil	..	..	..	Not more than 5 per cent.
Salt	..	..	..	" " 4 "

Such a meal should be light-brownish in colour, well-ground and free from large pieces of bone, and should not have the markedly offensive smell associated with decayed fish. If the moisture content does not exceed about 10 per cent the meal should keep well for a considerable period in a dry store, preferably with wooden floor.

Value as Food for Live Stock.—In Scandinavia and elsewhere on the Continent fish meal has been found very useful in the feeding of horses, cattle, sheep, pigs and poultry. In this country its use for pigs and poultry is now widespread and increasing, whilst recent experiments indicate that it forms a satisfactory food for calves.

Horses.—Fish meal has been fed with satisfactory results to horses up to an amount of 2 lb. per head per day. The fish meal must be given in admixture with other foods and introduced very gradually into the diet, otherwise very great difficulty may be experienced at first in securing satisfactory consumption. It should be particularly useful when supplies of good hay are scanty and much straw is consequently fed.

Cattle.—Fish meal has been used with satisfactory results, to the extent of 2 or 3 lb. per head per day by Scottish cattle feeders. Difficulty has been experienced in some cases in securing satisfactory consumption at the outset, but with a little ingenuity in blending the foods this is soon overcome. The richness of fish meal in albuminoids marks it out as a particularly suitable supplement to a diet of roots and straw.

Milch Cows.—Experiments in Scandinavia and elsewhere have demonstrated that fish meal can be fed to dairy cows to the extent of 4 lb. per head daily or even more without imparting a fishy taint to the milk. In view of the special requirements of milch cows for albuminoids, fish meal would thus appear to be distinctly useful for milk production. Its use under the conditions of average farm practice, however, must always involve a risk of direct contamination of the milk through the agency of the milker rather than that of the cow, especially where the milker has occasion to handle the foods before milking. Only where the greatest care is taken to avoid such contamination can the

use of fish meal for milch cows be recommended, but, if the necessary precautions are taken and a limited proportion of fish meal, say not exceeding 3 lb per head per day, is fed, no undesirable consequences need be feared.

Calves.—For calf-rearing purposes the richness of fish meal in albuminoids and "bone phosphate" must be regarded as particularly advantageous. In recent experiments on the rearing of calves on whey and meal mixtures satisfactory results have been obtained with mixtures containing fish meal.

In experiments at Kilmarnock in 1916 and 1917 the following mixtures were used:—

- | | |
|---|---|
| (1) Oatmeal, 2 parts.
Fish Meal, 1 part. | (2) Fine Thirds, 2 parts.
Fish Meal, 1 part. |
|---|---|

In experiments carried out at Reading in 1918, under the auspices of the Board of Agriculture, the following mixtures containing fish meal were included in the tests and gave satisfactory results*:—

- | | |
|--|--|
| (1) Linseed Meal, 3 parts.
Bean Meal, 3 parts.
Fish Meal, 1 part. | (2) Linseed Meal, 3 parts.
Fish Meal, 1 part. |
| (3) Linseed Meal, 3 parts.
Finely Ground Oats, 3 parts.
Fish Meal, 1 part. | |

In the Kilmarnock experiments the meals were fed in the form of a porridge, but in the Reading experiments they were consumed in the dry state, at the rate of 1 lb. meal per gallon of whey. Although these mixtures were specially intended for use with whey, there is no reason why similar mixtures should not do equally well for other conditions of calf-rearing. Fish meal used for calf-rearing should be of the best quality, and finely ground.

Sheep.—Fish meal is a useful supplementary food for sheep on roots, and may be given at the rate of 2 to 3 oz. daily per 100 lb. live weight, in admixture with pulped roots or other food. It should be particularly useful for ewes in milk.

Pigs.—Experiments conducted by the Seale-Hayne Agricultural College, the University of Leeds, and the West of Scotland Agricultural College have all confirmed the view, which is steadily gaining ground in practice, that fish meal is an excellent feeding-stuff for pigs. In the Leeds experiments in which fish meal formed from one-ninth to one-seventh of the total dry food, rising in the last month to more than 1 lb. per head daily, no detrimental influence upon the appearance,

* See this Journal for April, 1919, p. 39.

colour, smell or cooking qualities of the meat could be detected. It is to be hoped, therefore, that bacon factors will take a more tolerant view than has prevailed in some quarters in the past as to the suitability of fish meal for pig-feeding under proper conditions.

In purchasing fish meal for pig-feeding it is necessary to ensure that the meal does not contain more than a very small percentage of salt, or detrimental results may ensue.

Poultry.—Fish meal is now largely used in poultry-feeding and gives very good results where the necessary precautions are taken. It is desirable that the fish meal should be introduced gradually into the diet and that the proportion used should not exceed one-twentieth of the whole diet in the case of chickens, or one-tenth in the case of adult fowls. It may be used rather more liberally for ducks.

The necessity of avoiding a salty meal referred to in the case of pigs is even more important in the case of poultry.

(This article will be issued as Leaflet No. 333.)

MODERN LABOUR-SAVING IMPLEMENTS.

THOMPSON CLOSE,

The Food Production Department of the Board.

THE labour position and the level to which wages have risen make it necessary for all farmers to rely, to an extent never before known in this country, upon machinery and implements which will economise labour. The farm of the future will demand an ever-increasing degree of mechanical skill, and the trend of events will cause the farmer to eliminate the less intelligent men who are unable to handle modern machines skilfully. This process may be gradual, but inevitably the farmer who is unwilling or unable to employ the most efficient machinery, or who is unable to obtain or pay for skilled labour, will be driven from business.

For many years before the War there was by no means a universal eagerness to try and put into use labour-saving machinery. Farmers of the present generation can well recollect the slowness with which the binder came into general use. Even in the years immediately preceding the War, there were districts in which migratory unskilled labour was

preferred to the machine. Frequently, where a farmer relied upon low-paid unskilled labour he found fault with the modern machinery which was to supersede it; but the fault was at least as frequently in the inefficient labour as in the machine. When the binder was first introduced, the farmer almost invariably had to take charge of it himself if he wished to get good results, and even to-day the ordinary labourer who can take charge of the machine is an exception.

The farmer is, therefore, faced with two problems. He has first to make up his mind which machines and implements can be most economically employed on his land, and he has then to obtain labour which can handle them. He can obtain information as to the more important machines put on the market from the agricultural press, and from time to time articles upon the subject will appear in this *Journal*. The farmer has been afforded exceptional opportunities during the past two years through seeing Government tractors and tractor machines at work; but there are in most districts at all times opportunities for seeing new machines at work which have been introduced by progressive farmers. There is still room for demonstrations of improved devices under the auspices of public bodies or societies free from any interested motive, which will afford opportunities to farmers in all districts to make themselves acquainted with the possibilities of new machines.

The education of the labourer and even of the farmer in the use and maintenance of farm machinery is a matter which still requires much attention on the part of the State and the agricultural community.

A great many lessons have been learnt during the War, and the use of tractors and tractor implements has come to be appreciated. Tractors were dealt with in an article in this *Journal* for December, 1918, p. 1,045; a further article on this subject may await the results of recent British enterprise which may be forthcoming at the Lincoln trials in September. In the present article it is proposed to deal generally with the types of tractor implements in use, and to indicate the possibilities of further developments.

It may be said generally that tractor implements have reached a higher stage of development than the tractor itself. The general principles of construction are those of horse implements, and although modifications in points of detail will be necessary, it is largely a question of adapting existing implements to tractor draught. Short of a revolution in the

method of tillage—which is always a possibility, although perhaps a remote one—important changes are likely to be slow and few.

Ploughs.—In the construction of tractor ploughs the British manufacturer has undoubtedly lagged behind his American competitor. One great fault of the British manufacturer was that he did not appreciate the fact that the saving of labour was of prime importance. This lack of perception is shown, for example, in the construction of ploughs which were not of the self-lift type. The fault is, however, remedied in the more recent types of ploughs manufactured in this country.

What is the advantage of the self-lift plough? The tractor driver operates both tractor and plough, and thereby halves the labour bill. The objection raised is that one man is required to keep the breasts clean, but, if breasts are properly burnished off, trouble on this head is not frequent. An Oliver plough—to name a popular American type—very seldom clogs up, owing to the highly finished workmanship on the breasts of the machine.

Another fault of British makes has been their rather heavy construction, and until recently insufficient attention has been paid to wheel bearings, for, of course, the wheels of a tractor plough require greater bearing surface than those of a horse-drawn plough. In some American types, at least, these faults were not found, and the British manufacturer has cause to be thankful that mistakes of another kind were made by importers of American ploughs. It was a mistake, for example, to introduce an Oliver plough with the very abrupt bottom and wide furrow, which gained for it a considerable amount of unpopularity in this country, although the general construction of the plough is good and the firm produce a very wide range of types.

There has been a certain amount of controversy as to the number of bottoms with which a tractor plough should be provided. Both in America and in Central Europe, tractors of powerful types have been employed to draw four to eight furrows and more, but the experience of the last few years has shown conclusively that, for English conditions, light tractors, drawing two or three furrows, are the most efficient and economical for general purposes. Even now there is a tendency to overload a tractor by requiring it to pull three furrows under conditions where with two furrows the work would be done as quickly, if not more quickly, and with far less strain upon the engine. Much good work has, of course, been done with

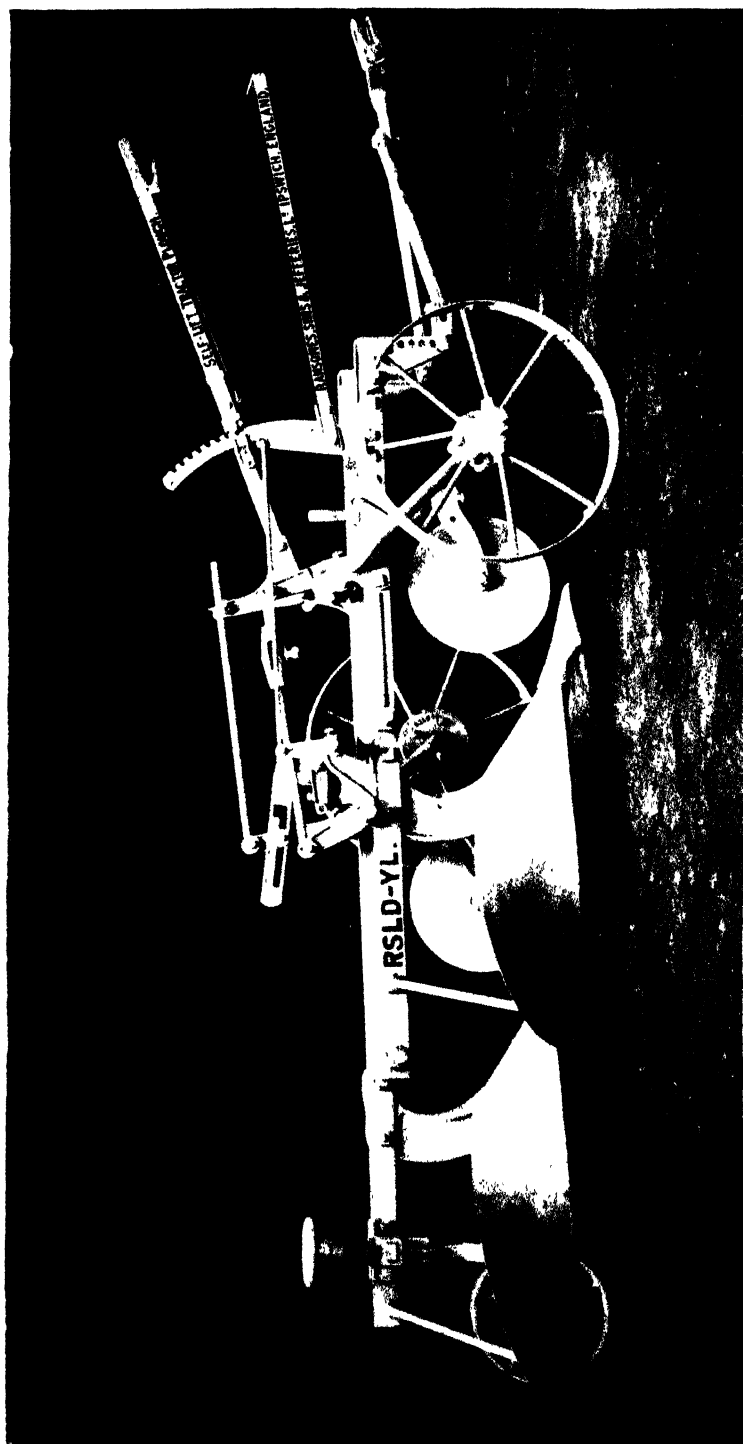


FIG. 1.—Ransome Two-Furrow Self-Lift Plough.

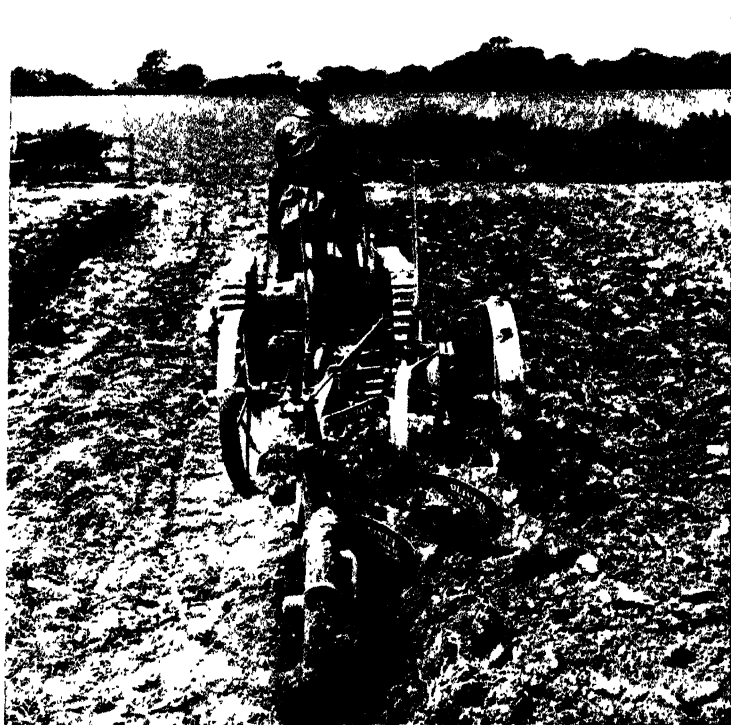


FIG. 2 —Oliver Two Furrow Self-lift Plough.

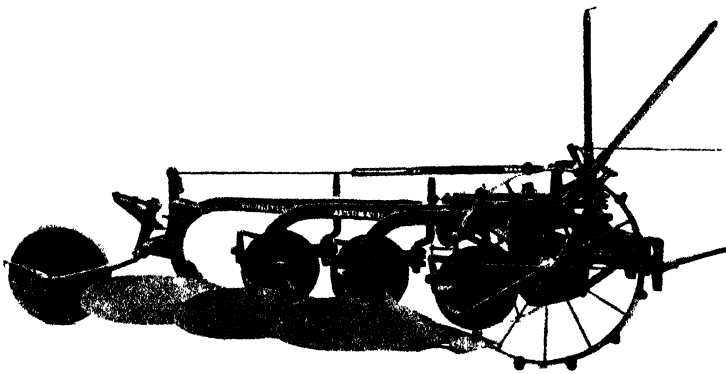


FIG. 3.—Oliver Three-Furrow Self-Lift Plough.

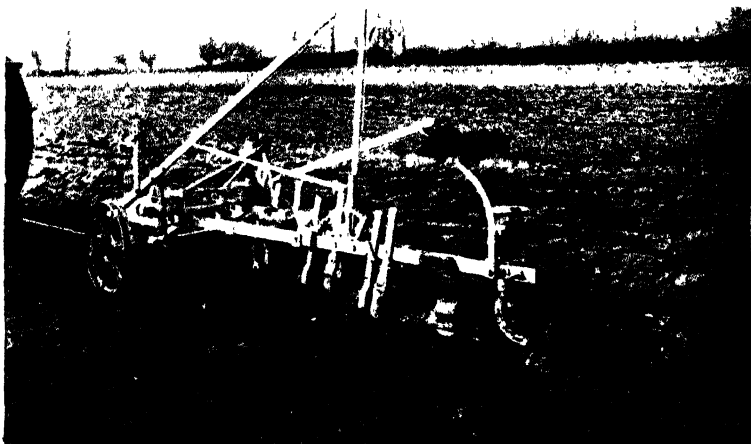


FIG. 4.—Ransome Three-Furrow Riding Plough.



FIG. 5 — Ransome Three-Furrow Riding Plough followed by Land Presser

Ransome, Cockshutt and other three-furrow ploughs under suitable conditions, and the latter has the advantage of being convertible from two to three furrows during operations.

A great deal of inferior ploughing is entirely due to lack of skill on the part of the operator. It is sometimes difficult to get an efficient tractor driver, and even if this is achieved it does not follow that he can set his plough to the best advantage. The writer has frequently experienced this trouble when going round the country. Nothing looks worse to a farmer than to see his land ploughed up with unequal furrows, bad setting in and taking out of headlands, etc., faults which are entirely due to the unskilful handling and inexperience of the operator.

It is obvious that no plough is able to give universal satisfaction, different soils requiring different types, but each of the makes referred to hereunder may be classed as a general purpose type and will, it is considered, give satisfaction if skilfully handled. Of the American ploughs which have been recently introduced into this country specially for tractor work, the Oliver, Cockshutt and Hamilton appear to have given the greatest satisfaction. The *Oliver* ploughs of the types best known in this country are particularly suitable for cross-cutting in the spring and the breaking up of fallows. For this purpose when fitted with the No. 221 breast the Oliver plough breaks up the furrow, and the subsequent operations are made easier, the furrow being in a loose condition and ready for after cultivation. This, of course, applies chiefly to light and dry soils, but good work has also been done by this type of plough on stronger land. The *Cockshutt* plough is suitable for all operations requiring the use of the general purpose breast. It is more like the long-breasted English ploughs than the majority of imported ploughs. The *Hamilton* plough has proved itself to be very suitable for ploughing old seed or swath land. This plough will do good work on very hard land in the autumn where ploughs of some other types would not enter at all. The Hamilton is of the self-lift type, and is found to leave a clean-cut furrow in preparation for wheat sowing.

One of the best general types of English plough is undoubtedly the *Ransome*, which has made itself popular in many districts. The makers have recently added to the general utility of this implement by the adoption of the two-furrow self-lift pattern, and the writer has seen successful trials with this new plough, but where the heavier type of tractor is employed the three-furrow riding plough has certainly given

excellent results with the general purpose breast, leaving a clean well-set-up furrow so necessary in this country for frost action and drainage purposes.

Cultivators : Spring-tooth Type.—The Martin, Ransome and Nicholson are all of very much the same pattern, being adaptations of the old horse pattern, and they all have their particular good qualities. Here again it must be pointed out that the general complaints made against these implements are as a rule due to the fault of the operator. Unless he is carefully supervised—and this applies to both horse- and tractor-driven types—he will frequently fail to keep the levers at the proper depth, whereas, in the case of the old-fashioned wooden duckfoot drag this trouble never occurred, as there could be no alteration in depth when once started. There are still some points in construction in these machines that are being successfully improved upon, for example, extra bearing surface for road wheels, attention to the hitching gear to tractor, etc.

Disc Harrows.—These are most useful implements in the preparation of autumn seed-beds, and their employment on newly-broken-up ground will save many operations which would otherwise be necessary where any turf remains unbroken as the result of the previous season's ploughing. An excellent seed-bed is the result if the land is twice worked over when it is in dry condition. Long experience of the old type tine harrowing, when carried out under suitable conditions, shows that on clean land much labour would have been saved by the employment of the present type of disc harrow. It may, however, be noted in connection with this type of implement that, if used in the summer fallowing on land which abounds in twitch, additional labour may be necessary to clean the land, owing to the liability of the implement to cut up the rubbish and twitch into small pieces.

Implements used with Tractors.—The implements described above are those which are more generally in use with tractors in this country. The binder was used with the tractor fairly generally last harvest, and more particularly under the auspices of the Food Production Department. The tractor tends to travel at a greater speed than that for which the binder is built, and the wear and tear has been excessive. It will probably be found necessary to introduce a new design of binder for tractor work, one of stronger construction and adapted for a more rapid speed. It is quite common in America to run two or more binders behind a tractor, and this has already

been done in a few cases in England; the practice has not, however, been generally adopted.

The use of other implements with the tractor—harrows, drills, rollers, etc.—is still unusual, but in the near future it is certain that farm implements of all classes will be tractor-drawn. The tendency will be to use implements of greater width and capacity, a tendency already manifest in America.

Disc Drills.—A special word may be said as to disc drills, which are of comparatively recent introduction into this country. Although many types have recently made their appearance on the market, the writer is of opinion that it is advisable at the present stage to adhere to the coulter or duckfoot type, with a view of keeping the land clean. The imperfection of the disc harrows, which has been shown above, applies equally with regard to disc drills, when used on the lighter soils. The disc drills are liable to cut up and bury the rubbish if the land is foul, whereas the result of using the duckfoot or coulter drill is similar to that of the use of the cultivator.

"SHELLED" GRAIN IN OATS.

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The Seed Testing Station of the Board

IN dealing with oat samples at the Seed Testing Station it was noticed that an appreciable proportion of the samples contained not inconsiderable amounts of "shelled" grain; it was also apparent that the shelled grain did not usually germinate as well as the normal unshelled grain. It was, therefore, considered advisable to investigate the matter in greater detail.

It was found that shelled grain occurred to greater or less extent in samples of all the chief varieties, but that Supreme on the average contained considerably more shelled grain than did other varieties. The amount of shelled grain in samples varied from a negligible amount up to a maximum of about 5.7 per cent. by weight, or about 7 per cent. by numbers.

The results of germination tests conducted on both the normal unshelled and shelled grain in the case of 34 samples are set out in Table I. on p. 490.

It will be noted that on the average the shelled grain germinated 24 per cent. less than the unshelled; in a few cases

TABLE I.—*Showing the Germination of Shelled Grain found in Samples as compared with the Normal Unshelled Grain.**Percentage Germination.*

Variety of Oat.	No. of Samples averaged.	Normal Unshelled	Shelled.	Greatest and least Decrease (or Increase) shown by Individual Samples.
Black Winter ..	5	95	80	- 21 to + 1
Abundance	6	90	72	- 27 to - 5
Victory	2	99	81	- 22
Yielder	1	97	58	- 39
Rival	1	97	69	- 28
Hero	1	84	55	- 29
Canadian Oat ..	1	98	81	- 17
Supreme	9	94	84	- 24 to + 1
Potato	1	98	39	- 59
Unnamed White Oats	7	92	78	- 64 to + 15
Average Figures for Samples	34	94	70 decrease = 24	Greatest decrease = 64.

the shelled grain gave germinations 50 per cent. less than the unshelled, and in one instance the decrease was 64 per cent. In five cases only was the germination of the shelled grain as good as or better than that of the unshelled. The shelled grain out of three samples germinated better than the unshelled; in two of these the increase was insignificant, being but 1 per cent., and in one case only did the germination of the shelled grain exceed that of the unshelled by a substantial amount, *i.e.*, by 15 per cent.

It was at first thought that the poor germination of shelled grain might have been due to the effect of natural drying on the unprotected grain.

In order to test this point, a number of samples were selected, and a proportion of the grain of each was carefully hand-shelled.* Both the hand-shelled and unshelled grain were then dried for varying periods at different temperatures, and were subsequently germinated. The results obtained are given in Table II.

* It was found impossible to shell the grain satisfactorily by any means other than by carefully splitting open the husk with a knife and then tearing it off. This proved at best a laborious business, but with practice the assistant concerned with these investigations became exceedingly expeditious at the work.

TABLE II.—*Showing the Effect of Drying on Normal Unshelled and on carefully Hand-shelled Grain.**Percentage Germination and Variety of Oat.*

Treatment.	Victory.		Hamilton.		Goldfinder.		Record.		Bountiful.	
	Normal.	Shelled.	Normal.	Shelled.	Normal.	Shelled.	Normal.	Shelled.	Normal.	Shelled.
3 days at 40° C. ..	98	97	97	95	92	92	—	—	—	—
7 days at 40° C. ..	100	98	98	96	98	91	—	—	—	—
19 days at 40° C. ..	100	98	100	94	92	92	—	—	—	—
2 months at 40° C. ..	100	100	95	97	97	95	—	—	—	—
10 hours at 50° C. ..	98	91	—	—	—	—	—	—	—	—
1 hour at 60° C. ..	—	—	94	98	94	100	—	—	—	—
20 minutes at 80° C. ..	92	90	96	100	94	92	—	—	—	—
3 hours at 80° C. ..	—	—	—	—	—	—	87	97	77	87

These figures indicate that hand-shelled grain, on the average, does not behave differently from normal grain as the result of drying; indeed, with one exception, the only cases where a substantial difference occurred showed shelled grain to be more resistant to drying at a high temperature than normal grain. It is thus evident that the poor germination of shelled grain occurring in ordinary samples cannot be due to the effect of drying. The figures given in Table II. also seem to show that when grain is carefully shelled by hand the germination is no worse than that of normal grain. It was, therefore, decided to hand-shell the grain from 30 additional samples and to compare the germinations given by the normal and hand-shelled grain. The results obtained were as follows:—

Average germination for normal grain, 95 per cent.

Average germination for hand-shelled grain, 96 per cent.

In five cases the hand-shelled grain germinated 5 per cent. or more in excess of the normal. *The greatest increase was 14 per cent.*

In two cases the normal grain germinated 5 per cent. or more in excess of the hand-shelled. *The greatest increase was 8 per cent.*

These tests proved that hand-shelled grain, on the average, germinated just as well as the normal, and that hand-shelling was, if anything, more likely to increase than decrease germination.* The above facts led to the assumption that the poor germination of shelled grain in samples was simply due to mechanical injury during the threshing operations. A number of tests were, therefore, arranged with a view to examining the process of germination in the case of shelled grain known

* It is therefore possible that hand-shelling might prove of some assistance in the case of samples with poor energies of germination such as those referred to in a previous article. See "The Effect of Drying on the Germination of Cereals" in this *Journal* for July, 1919, p. 364.

to be of poor germinating capacity. The results of these tests are given in Table III.

TABLE III.—*Showing the Manner of Germination of Shelled Grain of poor Germinating Capacity.*

No. of Samples from which the Shelled Grain was taken for each Test.	Germination of the Normal Unshelled Grain taken from the same Samples.	Germination of the Shelled Grain in 14 days.			
		Plumule only Embryonic and Adventitious Roots absent.	Plumule and Adventitious Roots only.	Normal Germination with Protrudence of Embryonic Roots.	Total Germination, i.e. counting the Grain which developed Roots in 14 days, whether Adventitious or Embryonic as Germinated.
Two ..	91	19	3	24	27
Six ..	93	9	3	57	60
Three ..	94	7	2	72	74
Three ..	98	3	6	81	81
Average Figures	94	9	2	58	60

It will be seen from the table that, on the average, 40 per cent. of shelled grain was incapable of any growth, and that from 3 to 22 per cent. of the grain germinated abnormally. The chief feature of this abnormal germination was that the embryonic roots never developed, and that only the plumule protruded; in some cases, however, adventitious roots subsequently sprang out from the lower node of the stem.

The manner of germination of the shelled grain suggested, therefore, that the embryo had been injured in some cases sufficiently to prevent germination entirely, and in others that the injury had been confined to the region of the coleorhiza, thus rendering the embryonic or "seminal" roots incapable of development.

In this connection it is interesting to note that, in the case of the 30 samples which were carefully hand-shelled, only 0.3 per cent. of the grain thus shelled germinated abnormally, and in one sample only did the abnormal germination reach an appreciable figure (*i.e.*, 5 per cent.); in all other cases it was less than 1 per cent.

A careful inspection of shelled grain showed, moreover, that it was possible within certain limits to recognise the badly-injured grain. In some cases the tip of the grain at the radicle end was actually broken off, whilst in others it had been more or

less abraded. About 700 grain were examined under a Zeiss binocular, the more obviously injured grain being separated from the apparently uninjured and subsequently germinated. The results of these tests are given in Table IV.

TABLE IV.—*Showing the Manner of Germination of Badly-damaged and of apparently Undamaged Shelled Grain.*

Reference.	Normal Germination.	Plumule only.	Plumule and Adventitious Roots only.	Dead.
<i>Badly Damaged.</i>				
A	15	16	9	60
B	12	8	9	71
C	28	23	18	31
Average Figures	18	16	12	54
<i>Apparently Undamaged.</i>				
D	86	5	2	7
E	67	2	2	29
F	69	0	9	22
G	55	9	10	26
Average Figures	69	4	6	21

The results show that the separation into badly-damaged and undamaged grain was only partial, but that the percentage germination of the former was considerably less than that of the latter; the abnormal germinations were also greatest in the case of the badly-damaged grain. The figures tend, however, to confirm the view that the poor germination of shelled grain is due to mechanical injury. A few further tests were, therefore, conducted to ascertain the minimum amount of mechanical injury that was necessary to affect germination adversely. About 600 hand-shelled grain were divided into three lots and subjected to the following treatments: (a) The grain was rubbed in a cloth. (b) The radicle end of the grain was lightly rubbed on a hard surface. (c) The extreme tip of the grain (radicle end) was nipped off. It was found that the grain rubbed in a cloth suffered no injury. The grain lightly rubbed on a hard surface dropped 5 per cent. in germination and gave 10 per cent. abnormal germination. The grain that had the extreme tips nipped off did not lose in total germination, but in one test 18 per cent. of the germinations were abnormal; in a second test, 12 per cent., and in a third 6 per cent. of the germinations were abnormal.

Summary.—It has been shown that a certain amount of shelled grain is of common occurrence in oat samples. The amount present does not usually exceed 3 to 5 per cent. by weight. It occurs most frequently and in greatest amount in the Supreme variety.

On the average, shelled grain germinates about 24 per cent. below the normal unshelled grain, which constitutes the bulk of the sample. This relatively poor germination is not due to the influence of drying on the unprotected grain, but would seem to be due to mechanical injury during the threshing operations. The amount of injury varies very much, in some few cases the shelled grain germinates practically as well as the unshelled, whilst in extreme cases the germinates may be as much as 60 per cent. less. The degree of injury also varies in respect of individual grain taken from the same sample; the damage done may be sufficient to prevent germination, or it may only be sufficient to damage the radicle end of the embryo, and so cause abnormal or "plumuler" germination. It is probable that the amount of shelling that takes place and the extent of damage done to the shell grain depend both upon the condition of the grain when threshed and the "setting" of the machine. These are points which it has not been possible to study, and which would doubtless repay investigation.

Percentage of Husk in different Varieties.—In connection with the work described in this paper it was necessary to hand-shell a large amount of grain. It was thought worth while, therefore, to ascertain the percentage of husk in the case of a number of the chief varieties of oats received at the Station during 1917-18, representing the harvest of 1917. The figures obtained are set out in Table V., the weight for 1,000* grain being also shown. The figures in brackets appearing against some of the varieties are those recorded at Leeds, being the average of results obtained in 1900, 1901 and 1902.†

It should be stated that the grain was not dried for a given time at a uniform temperature before it was weighed, or before it was shelled. The work was, however, conducted late in the season, so that the samples were air-dried in their sample envelopes for a number of weeks.

* The weight of 1,000 grain was in no case based on weighings of less than 500 seeds. The weight of husk was in no case based on less than 200 grain.

† Smith, W. G. "Investigations on the Grain of Oats." The Yorkshire College, Leeds, Bull. No. 27.

TABLE V.—*Showing the Weight of 1,000 Grain, and the Percentage of Husk in 26 Varieties of Oats.*

Variety.	Weight per 1,000 Grain in Grams.	Percentage of Husk.
Sandy	24.54 (25.2)	24.09 (26.49)
Potato	28.63 (27.6)	23.30 (27.21)
*Longhoughton	29.14 (26.5)	22.54 (26.94)
Hamilton	29.69 (26.6)	23.89 (27.13)
Black Tartarian	29.99 (29.0)	29.66 (29.33)
Goldfinder	31.27 (32.9)	24.04 (24.49)
*Golden Rain	31.84	24.56
Banner	34.93 (31.0)	24.84 (25.57)
*Rival	35.54	25.07
Newmarket	35.98 (36.6)	25.74 (25.45)
Waverley	36.64 (32.9)	24.00 (26.20)
Victory	36.72	25.69
Abundance	37.91 (36.8)	24.94 (25.22)
*Swedish Crown	37.68	23.31
*White Crown	37.03	23.31
Record	37.40	27.64
Supreme	37.59	28.91
*Wideawake	38.36	24.70
Hero	38.47	28.09
Bountiful	38.91	29.31
Prolific	39.42	25.62
Leader	40.84	27.21
Yielder	40.22	24.89
*Black Mogul	41.06	30.07
Tartar King	43.34 (37.3)	28.78 (31.94)
*Storm King	51.18 (45.9)	30.48 (32.21)
Average Figures	36.32	25.95

* The figures given above for these varieties were based on one sample only; the other figures were based on the average of from five to nine samples, except Abundance, of which there were 16 samples.

In making comparisons between the Leeds results and those obtained at the Seed Testing Station, it must be borne in mind that the former tests were conducted on oats grown on trial plots at Garforth, whilst the latter were conducted, in the majority of cases, on a mixture of samples grown in different parts of the country.

According to the Leeds trials, Abundance, Newmarket, Waverley and Black Tartarian are oats which show the least variation from year to year, and it is interesting to note, therefore, that, with the exception of Waverley, the results given by the samples of these varieties here tested (1917) are very similar to those recorded at Leeds (1900-1902). The samples of older varieties, such as Sandy, Longhoughton, Hamilton and Potato, were shown by the Leeds trials to give a lower percentage of husk in the wet season, 1902, than in the dry seasons, 1900

and 1901. The results obtained at the Seed Testing Station tend to confirm this, for 1917 was also a wet season, and the percentage of husk was very similar to the Leeds 1902 figures, and considerably lower than the average figure based on two dry seasons and one wet one. In wet seasons, therefore, these four old oats give lower percentages of husk than do most varieties; in 1917, Swedish Crown, White Crown, Goldfinder and Waverley were the only oats which gave equally low percentages of husks.

A heavy weight per 1,000 grain with a low percentage of husk may be taken as an important quality in oats, and it also correlated with good cropping and "standing" capacities would usually be sufficient to stamp a variety as excellent. It will be seen that Swedish Crown, White Crown, Wideawake, Yielder and Prolific, all with small proportions of husk, were amongst the heaviest-grained varieties. Storm King, Tartar King, Black Mogul and Leader were amongst the heaviest oats, but the samples tested had high percentages of husk. It is thus evident that the newer varieties of oats tend to be of good weight and that some at least of these have also a low proportion of husk.

Abundance, Newmarket and Goldfinder had low percentages of husk and were also of very fairly good weight; the same was true of Waverley on the basis of the 1917 figures, but not on the Leeds 1900-1902 figures.

The percentage of husk in the leading varieties will be again ascertained this season; and it is hoped to accumulate data on these lines over a number of years.

In this connection it may not be out of place to urge upon both farmers and merchants, and also Agricultural Organisers and other Educational Authorities, the importance of furnishing the Seed Testing Station with particulars as to the county in which samples sent to the Station were actually grown, or with such other particulars as may be of scientific interest. This information is of the greatest use with reference to the collection of statistical data, and would be of considerable assistance in connection with such investigations as it may be found possible from time to time to undertake.

THE WORK OF THE ROTHAMSTED EXPERIMENTAL STATION FROM 1914 TO 1919.

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THE work of the Rothamsted Experimental Station during the last five years falls into two main groups: problems connected directly with the War, and those connected with the development of agriculture after the War. The war work had the advantage that its significance was obvious, but on the other hand some of it was only of temporary importance, and depreciated considerably in value with the passing of the emergency with which it was intended to deal. The other work has more permanent value; it holds good even after the emergency has passed, but during the War it was sometimes overshadowed by the more pressing and immediate needs of the moment.

War Work at Rothamsted.—During the first year of the War very little direct war work was done at Rothamsted. Food was still coming into the country in large quantities and there was no great interference with food production at home. Supplies of fertilisers and feeding stuffs were ample. There was, however, fear of unemployment, and three schemes were examined at the request of the Board of Agriculture, with the view of ascertaining whether they would usefully employ any considerable number of men, and if so, whether they would contribute to the national profit. These were a proposed development on Foulness Island in Essex, the suggested afforestation of the spoil heaps and pit mounds of the Black Country, and the reclamation of Pagham Harbour in Sussex. None of these schemes was further developed, though two of them—the planting of the spoil heaps in the Black Country and the reclamation of Pagham Harbour—possess aspects of permanent interest. The spoil heaps are useless and unsightly; they can, however, be planted with trees, when they take on a very different appearance, as shown at Reed Park, Walsall. Although the financial returns may not be very great, the improvement in the amenities of the district would be considerable. The proposition is, however, hardly an agricultural one.

The most important war work began in 1916, when the food situation gave cause for much anxiety. The position was

really very serious. The submarine menace was looming before us, terrible in its unfamiliarity, conjuring up visions of food shortage, if not of starvation; the only way out of the situation seemed to be the production of our own food in our own country. At the time we were producing only one-half of our total food, and the remainder was coming from abroad. When examined in detail the position was found to be more serious than it looked. The food produced at home included more of the luxuries than of the essentials. It included, for instance, the whole of the highest quality meat, but only one-fifth of the bread. The farmer was, therefore, called upon to perform a double task; he had to produce more food, and different food. He had to give us, not one loaf out of every five that we ate, but three or four out of every five, and to do this without causing too great a shortage of milk, meat, and, if possible, beer. The situation presented many difficult administrative, financial and technical problems. The technical problems involving soils and fertilisers were dealt with at Rothamsted.

The fertiliser problems arose out of the necessity of making the very best use of the limited stocks of the ordinary fertilisers to which the farmer was accustomed, and of examining any and every substitute that promised help in eking out the supplies. Fortunately, a good deal of information could be drawn from the Rothamsted and other experiments as to the best way of using fertilisers on particular crops. This was systematised and put in order in a little handbook called "Manuring for Higher Crop Production," issued at a cheap price (1917: 3s. 6d. net.) by the Cambridge University Press so that the farmer could readily obtain it. In addition, a series of Notes was issued in this *Journal* showing how the available supplies might best be utilised.

It was more difficult, however, to give useful information about the substitutes that would be needed if and when the fertiliser supplies became too much reduced. Ordinarily fertiliser tests have to be continued for two or three successive seasons before a definite opinion can be expressed as to their value; during the War, however, some sort of opinion had to be given in three or four weeks. Rapid methods of laboratory testing were therefore developed: growing seedlings were used to indicate whether (as not infrequently happened) toxic substances were present; rates of nitrification in soil were determined to find out how far the substance would yield nutrient material to the plant; farm crops were grown in pots

to afford opportunities for testing any material that might seem promising. A considerable number of possible fertilisers were sent in for examination by the Board of Agriculture and Food Production Department, the Ministry of Munitions, the National Salvage Council, and other bodies.

Much of the information was wanted for the purpose of economising sulphuric acid, so that the maximum quantity might be handed over to the Ministry of Munitions for the manufacture of explosives. In peace time the farmer had been the chief consumer of sulphuric acid; in 1917, however, the Ministry of Munitions were requiring all the acid they could find, and were leaving much less than usual for the fertiliser manufacturers. Even in pre-war days the farmer had required 870,000 tons of chamber acid per annum (equivalent to 580,000 tons of pure acid), and the extra food production programme was calling for even more than this. The Ministry of Munitions were, however, obdurate, and cut down supplies at a rate which seemed to some of the more nervous to threaten a very serious situation. The production of sulphate of ammonia fell from 350,000 tons per annum to little over 250,000 tons, while that of superphosphate fell from 800,000 tons to 500,000 tons per annum.

Fortunately a substitute for sulphate of ammonia was available in the form of nitre cake, and although no fertiliser manufacturer liked it or had a good word to say for it, it seemed as if it might have to be used extensively in the manufacture of superphosphate and of sulphate of ammonia. Important and difficult technical problems were involved both at the factory and on the farm, necessitating a considerable amount of experimental work. Thanks to the co-operation of the manufacturers, working solutions of the difficulties were found, and there is little doubt that both sulphate of ammonia and superphosphate could have been made from nitre cake had the necessity arisen. Fortunately it did not, and the situation was eased before it became too serious.

A considerable amount of work was also done in the examination of new sources of potassium compounds to take the place of the Stassfurt salts which had previously been our sole source of potassium compounds. A certain number of residues from manufacturing processes were available, but in the main they suffered from one or both of two defects, very low content of potash likely to be useful to the plant, and the presence of toxic substances. After much sorting out of possible materials it appeared that certain blast furnace flue dusts would prove

suitable, and accordingly the Food Production Department took steps to make the necessary arrangements for distribution among farmers. Considerable quantities have been used, generally with distinct advantage. With the re-establishment of peace conditions, supplies of potassic fertilisers may be expected from the Continent.

Investigation was also made into the possibility of using to better advantage the farmyard manure produced on the farm, and of using as fertiliser various substances now wasted.

It is estimated by Hall and Voelcker—admittedly good authorities—that some 50 per cent. of the value of farmyard manure is lost on the average farm of the country through avoidable causes. Thanks to the generous assistance of the Hon. Rupert Guinness, it has been possible to retain an expert chemist, Mr. E. H. Richards, expressly for the purpose of elucidating the causes of the loss, this being necessary before one could hope to find a remedy. The causes of the loss have been traced in an extended series of laboratory investigations, and the conditions necessary for its avoidance have been ascertained.*

Broadly speaking, the conditions to be secured in the making of the manure as ascertained by Dr. Hutchinson are sufficient supplies of nitrogen compounds and of air to allow the cellulose-decomposing organisms to effect the decomposition of the straw. For the storing of the manure, however, Mr. Richards' experiments show that it is necessary to have shelter from the rain and also to prevent access of air. The best methods for securing these conditions have required working out for particular cases, which can be done only after consideration of all the local circumstances.

Field experiments have shown that farmyard manure stored in conformity with these conditions is of higher fertilising value than the ordinary material, the crop being 10 per cent. or more beyond that given by manure kept in the usual way. During the War, when all sources of loss had to be studied, and as far as possible stopped, the necessary conditions were vigorously brought to the notice of farmers and Executive Committees by the Food Production Department, and at different times attention has been drawn to the matter in this *Journal*. Savings of several units per cent. on old-established practice are possible, and every one per cent. saved would mean in the aggregate some £200,000 a year at present prices.

* An article on the subject appeared in this *Journal* for December, 1914, p. 800.

A beginning has been made with a much more difficult problem—the handling of manure on a dairy farm. The conditions here are very different from those on an ordinary mixed farm where bullocks are fattened: it is desirable that the dung should be as little in evidence as possible and that the urine should be quickly and completely removed from the cow-sheds. So important is this that it must be done even if loss is thereby incurred. Two methods have been studied:—

(1) The removal of the solid excreta and its storage under cover and out of reach of air; collection of the liquid manure in a tank, and its application to temporary or permanent grass land and on the stubbles prior to taking a root crop.

This method is already in use on certain dairy farms, but careful examination revealed a considerable deficit on the nitrogen account: the liquid only contained about one-half of the nitrogen expected. The loss was traced to the broken straw and solid excreta which always find their way into the liquid and cause an absorption of nitrogen which, though of scientific interest, may prove costly to the farmer, and at any rate deprives the liquid of much of its value.

Further investigation of this absorption is being made; it may be avoidable, in which case the value of the liquid manure, already high, could be enhanced still further. In case it seems to be unavoidable, however, a second method of procedure is being adopted:—

(2) The solid manure is collected as before, but the liquid is allowed to run through straw under conditions which encourage the absorption of nitrogen compounds. By suitable arrangement the straw increases in fertiliser value, while the liquid loses part of its valuable constituents, and can more easily be sacrificed.

This second method is still in the laboratory stages, but may prove of considerable value. Mr. Richards is carrying out the laboratory experiments at Rothamsted and the large-scale experiments at Woking on the Hon. Rupert Guinness' home farm.

The Making of Farmyard Manure without Animals.—Two years ago there seemed a prospect of a considerable surplus of straw, and methods of utilisation were examined; in particular the possibility of converting it into a useful manure was studied at Rothamsted.* The prolonged drought of this season has dispelled any prospect of excessive straw, but the value of the work remains.

* See this *Journal*, April, 1919, p. 15.

The investigation is being carried out by Dr. Hutchinson and is the logical continuation of work that he has had in hand for some time. Laboratory work has shown that the breaking down of the material of straw, the so-called cellulose, is effected by a remarkable organism which had eluded all previous investigators, but which Dr. Hutchinson succeeded in obtaining in pure culture so that he could study its properties. In order that it may bring about the decomposition of straw it requires two conditions, air and soluble nitrogen compound, as food. If either of these is missing it ceases to act. Moreover, it will only attack cellulose: it is unable to feed on sugar, starch, alcohol or any organic acid yet tried.

Given, however, the necessary nitrogen compounds and a sufficiency of air, the organism quickly decomposes straw, breaking it down to form a black, sticky material, looking very much like farmyard manure. A ton of this material is now being prepared for the purpose of fertiliser tests.

Sewage Sludge as Manure.—Many efforts have been made in the past to utilise sewage sludge, but until recently without success. A new process is now being studied which seems more promising; it gives a sludge containing 6 per cent. or more of nitrogen in an easily available form. There are, however, a number of problems to be solved before its agricultural value can be established, and work on these is being pressed forward as vigorously as possible. An experimental plant has been erected at the Harpenden Sewage Works, where sufficient material for new tests is being prepared.

The importance of the problem is manifest from the consideration that the total excrements of the inhabitants of the United Kingdom would be worth nearly £18,000,000 per annum as fertiliser if they could be applied to the land. Only a fraction is so used at present, but the need for national economy is such that nothing of value should be wasted.

Other Aids to Production. Lime and Artificial Fertilisers.—*Lime.*—Most farmers know by experience whether or not they require lime, but few use it as regularly as they ought, with the result that clover often fails to do well, and swedes become liable to finger-and-toe. Numerous analyses made at Rothamsted of soils from different parts of the country show how widespread is this lack of lime.

In trying to remedy the deficiency, however, difficulty has arisen because it is not always possible to tell a farmer how much lime the soil needs: often indeed one can only say that he should apply between 10 cwt. and 2 tons per acre. Of

course, if farming were independent of costs this vagueness would not matter, but the delicate financial balance under which agriculture has to be conducted leaves no margin for indecision between 10 cwt. and 2 tons. A method has, therefore, been devised by Dr. Hutchinson for estimating the degrees of lime requirement, and when it is known how much lime one part of the land needs the quantities wanted for the rest are readily ascertained.

Calcium Cyanamide.—Two new artificial fertilisers have been studied in some detail. Calcium cyanamide, commonly known in this country as nitrolim, is a fertiliser of distinct promise, about which, however, experts still have a good deal to learn.

In field practice it has varied considerably in effectiveness. On the average of all field trials in the United Kingdom, when the effect of nitrate of soda is taken as 100, that of sulphate of ammonia is 97 and of cyanamide 90. The cyanamide results, however, sometimes fall as low as 26 and occasionally rise as high as 238. Mr. Cowie has shown that cyanamide under certain conditions contains another substance, dicyanodiamide, which is poisonous not only to plants but also to the nitrifying organisms. It is less toxic to other organisms, however, and has little effect on the bacteria developing on gelatine plates, the rate and extent of the decomposition of dried blood, or the rate of production of ammonia from cyanamide. In its presence ammonia accumulates in the soil and the normal oxidation to nitrate does not take place. Dicyanodiamide, therefore, not only injures the plant, but cuts off the supply of nitrate, substituting instead ammonia, which in most cases is less useful, and in some cases directly harmful to the crop. The conditions under which it is formed are known and fortunately can be avoided.

A further investigation is being made into the breaking down of nitrolim in the soil. Nitrolim itself is not a plant food; under suitable conditions, however, it readily changes into such. Usually changes of this sort are brought about by living organisms under conditions which are now well understood. In this particular case, however, something else is involved, the exact nature of which is not yet clear, although Mr. Cowie is on its track. There is little doubt that some of the cases where nitrolim gave disappointing results arose through lack of the decomposing agent, whatever it may be.

Ammonium Nitrate.—Another investigation arose out of the necessity of making the best possible use of the materials

employed in the making of munitions, one of which—ammonium nitrate—had been accumulated in great quantities.

It was known some time ago that at the end of the War large stocks of this ammonium nitrate might be available for agricultural purposes. Experiments were, therefore, made to ascertain its properties as a fertiliser.* The material available before the War had been too deliquescent for ordinary use. A much less deliquescent modification is, however, now available; it has been stored for months in the Rothamsted manure shed without giving trouble. Further, it can be drilled with the utmost ease, either alone or mixed with superphosphate (though the mixture should not be stored). It gave good results on mangolds and potatoes and as a top dressing to cereals. It is highly concentrated, containing 35 per cent. of nitrogen.

Basic Slag.—Considerable attention has been devoted to basic slag. During the War there has been a great change in the composition of this material in consequence of the extension of the basic open-hearth process for making steel. The new material contains less phosphate than the old, and less is soluble in citric acid. Field experiments have been made to ascertain its actual value, and inquiries have been made in conjunction with Dr. Stead, of Middlesborough, into the possibility of improving its value.

Control of Soil Organisms and Pests.—Most farmers have learnt to their cost that soil is inhabited by a number of organisms, capable of doing a great deal of mischief; it is well known that there are others that do very much good. Considerable attention has been devoted at Rothamsted to the soil organisms, and much information has been gathered about them.

The wireworm furnishes a good example of the harmful organisms in the soil. In a general way its life-history has long been known, but little exact knowledge was available before Mr. Roberts began his work at Rothamsted; in consequence, no sound method of dealing with the pest could be suggested.

Mr. Roberts has, however, succeeded in tracing the precise history of the wireworm from the egg through the larval stage to the beetle, and has brought to light a great deal of new and useful information about it. Further experiments are necessary to discover the best way of using this information. Dr. Malcolm Laurie has carried out some interesting experiments which promise valuable results.

* See this *Journal*, February, 1919, p. 1332.

Mr. Tattersfield and Mr. Roberts have also devoted much attention to the effects of poisons on the wireworm. A large number of substances have been systematically tested, and many have been found far more poisonous than the naphthalene sometimes recommended. Ammonia is distinctly harmful to the wireworm—not the sulphate of ammonia used as a fertiliser, but ammonia itself—and it is interesting to note that this is produced in the soil when liquid manure is applied, or when sheep are folded on the land. Either of these methods may be expected to keep down wireworms.

It is hoped that the information obtained in these experiments will enable works chemists to make a satisfactory soil insecticide—one of the most urgent needs of the arable farmer and market gardener.

Some years ago it was shown at Rothamsted that the treatment of the soil with poisons led to increased productiveness if the poisons could subsequently be removed. The search for a soil insecticide is combined, therefore, with the search for a soil sterilising agent, and this part of the work is carried out by Mrs. Matthews, the W. B. Randall Research Assistant, Mr. Randall having generously provided the funds that enable the Station to secure Mrs. Matthews' services. The results are too technical for discussion here, but they show beyond doubt that simplification of the soil population is an advantage to the grower. For the present this information is of direct value only to the nurserymen working under glass.

For cucumber and tomato-growing under glass the most efficient method is to steam the soil, when the undesirable forms are reduced or eliminated, and the useful forms are less affected. Various poisons are now being used successfully, and are, fortunately, much cheaper than heat.

The co-operation of the chemist has led to some interesting developments. It was found in the early stages of the investigation that carbolic acid, which is sometimes phenol and sometimes cresol, was effective in dealing with important pests, but Mrs. Matthews and Mr. Tattersfield have greatly improved on this substance. They find that chlorphenol is about four times as toxic as phenol; di-chlorcresol, which is easily prepared on the large scale, is about five times as effective as cresol, hitherto the most potent agent available for practical purposes.

Some of the so-called poison gases are very effective, and if the practical difficulties attending their use could be overcome, they would form a valuable addition to the growers' equipment. This, of course, is work for the future; already, however, the

sterilising methods have considerably increased the output of glasshouse production in the Lea Valley.

A highly useful soil organism, the clover organism, has been studied in some detail and an important advance made by Mr. Bewley. Before this work was done little had been known of the way in which this organism lives when it is out of the plant. Mr. Bewley has now shown that it can exist in two forms—one form can move about, while the other cannot. The addition of soluble organic matter causes the latter to change^{*} into the motile form.

This fact is of great interest in connection with another result recently obtained at Rothamsted. It was found that clover makes more vigorous growth in a rotation where farmyard manure is used than where artificials only are used.* It seems legitimate to suppose that the farmyard manure helps the organism to become motile so that it can easily move about and enter the plant root; this hypothesis is being tested.

Special attention is being devoted to the processes whereby plant food is made in the soil. These processes are of vital importance because on them depends the proper utilisation of farmyard manure, clover residues and grass residues ploughed into the land. At present there is good reason to fear that only 50 to 60 per cent. of the potential value of these materials is ever realised: the rest is lost to the farm, and, of course, to the country. Improvements do not come from sensational discoveries; indeed many of the sensational discoveries announced in the Press turn out to be nothing but mare's nests. It is the steady advancement of knowledge that helps to solve agricultural problems; link by link the chain is forged until one day, unnoticed and unrecorded, the last link is made and the definite advance is achieved. Practice advances in the same way; a one per cent. improvement here, and a one per cent. improvement there, represents a much more solid achievement than many of the supposed discoveries that sometimes attract so much attention.

Weeds.—The study of the weeds of the farm is in the capable hands of Dr. W. E. Brenchley, whose results have been published from time to time in this *Journal*, and in the Journals of the Bath and West, and of the Royal Agricultural Societies; these results are now being collected, so that it is unnecessary to enter into any detailed account of them here.

Plant Pathology.—Farmers suffer great losses every year through the attacks of insects and fungi; in consequence the

* See this *Journal*, May, 1917, p. 124.

Board of Agriculture have recently set up at Rothamsted an Institute for Plant Pathology, the purpose of which is to study plant diseases.

Dr. A. D. Imms is in charge of the entomological work and Mr. W. B. Brierley of the mycological investigations. The primary purpose here, as in the rest of the Station, is to gain information and not to cure particular diseases: indeed it is not too much to say that, until some of the information at present sought is obtained, there will be little hope of cures for many of the ills affecting plants. The treatment of plant diseases is now in somewhat the same position as the treatment of human diseases in the days of the barber surgeons, and further advance can only come when more knowledge is obtained.

FARMING ON THE SOILING SYSTEM.

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As the soil condition of a country improves, new methods of farming are required to extract from the land the full returns which it is capable of yielding. A hundred years ago the four-course system of farming was displacing the open-field practice, and it was clear to all practical observers at the time that whatever the social drawbacks of the new system, as compared with the old, the former was capable of yielding much higher returns in agricultural produce. With the general adoption of the four-course system, and its modifications, the output of the land was greatly increased, and now, after a hundred years' experience of the system, its complete possibilities have been ascertained.

Up to a given point, land farmed on the four-course system can be profitably improved; beyond this, farmers wishing to adopt methods of improvement find that raising the condition of the land does not yield them greater profits, in fact the reverse is sometimes the case. In all classes there are a number who are constantly aiming at progress, and it is to this section of the farmers of this country that the soiling system of farming offers an opportunity. By its means they can obtain results in advance of what is possible under the present system.

The system is more complex, and possibly needs more skill, than ordinary farming, although the difficulties gradually disappear with experience. The labour involved is less than is

generally supposed, and the experience of several years leads to the conclusion that the cost in labour per unit of produce is not greater with the soiling system than with other methods of farming. Much of the labour involved in ordinary farming is eliminated by adopting this system and, on the balance, the increase in labour is far less than the increase in production. Those who have been employed on farming experiments during the last 20 years find it difficult to suggest improvement on the methods of the best farmers, however much room there may be for the education of the rank and file. The best farmers have clearly reached the limit of profitable production from land managed on the usual lines, and an entirely new system must be devised in order to secure a further advance on the best in British farming. The soiling system gives this opportunity. The soil-fertility can be doubled on the best four-course farming and with it the returns per acre, the soil being given twice its former producing power.

Forage crops have received comparatively little attention in Great Britain, owing largely to our dependence on grass, and little is known regarding their possibilities, but in other countries they are often the mainstay of the agricultural system.

An examination of English agricultural literature reveals surprisingly little information on this subject, and nowhere has complete investigation of this branch of farming been made. The soiling of cattle attracted much attention during the 17th and 18th centuries, but the recorded experiments and descriptions of the practice show that it was never systematically carried out.

Experiments on Soiling Crops.—With the object of remedying this deficiency in our agricultural knowledge, experiments were commenced several years ago at the Harper Adams Agricultural College, at first only with the growing of forage crops, but later with feeding them to cows and the general management of land farmed with forage crops. Many crops were tried, but the conclusion was arrived at that, for immediate use, the farmer who adopts the system must confine himself to the crops native to the country, and in general cultivation. The crops at present available, however, have been found sufficiently suitable for the purpose to establish a soiling farm system which will give a continuous supply of fodder throughout the year.

The first attempts to establish a soiling rotation were made with small plots, many mixtures being tried, and many failures

resulting from what appeared to be suitable combinations. Continuity was the most difficult problem in the early experiments; there was, for a long time, a danger of gaps between the crops during the summer months, but this difficulty has been gradually overcome. Two periods, 1st June–15th June and 15th August–31st August, have proved particularly difficult to provide for. The reason for the difficulty during August is that all native plants make their main effort to produce seed during the months of June and July, while August is the time of ripening. The rotation now adopted gives sufficient fodder to fill this period, but the yields are rather less than on the other plots, and it is necessary to sow a rather larger area to provide a given weight of fodder. Further experiments are being carried out with a view to improving the yields of the weaker sections of the cropping plan.

In 1915 the preliminary experiments were far enough advanced for a trial of the summer cropping to be made with two cows, which were kept indoors during the whole of the summer and fed entirely on fodder crops. The two cows were kept in the shed occupied by the cows going out to grass, and the test was not completely successful. A difficulty was encountered which showed clearly that soiled cows must be kept separate from those going out to grass. Immediately the two cows were tied up the milk yield fell, although they were given as much as they would consume of what appeared to be perfect fodder, the fall in yield being due to the restlessness of the soiled cows brought about through the rest of the herd being turned out. Further experience has shown that nothing has greater influence in depressing the milk yield than a restless state of the cows. This is a point of importance, as the best results are only obtained after the cows have become settled to life indoors, when they prefer the cowshed to the field in summer. A number of cows taken from grass, placed in a shed and fed on the best fodder crops, will drop in their milk yield, but if one or two cows are put into a shed where there are a considerable number already accustomed to the particular mode of life they will settle down immediately, and no particular fall in the milk yield will be noticed.

In 1917 it was determined to attempt the indoor summer feeding of milch cows on a larger scale, and a field of 7·2 acres was set aside for the purpose of providing the fodder crops. An old wooden shed was moved from an outlying field to a convenient situation and fitted with stalls to accommodate 12 cows and with an outside rack, the fodder being filled in from the

outside. This shed is of a very primitive type, but it has proved quite suitable for the purpose, and the cows have been kept in it during winter and summer, and have maintained perfect health. The only drawback to this shed is that it is insanitary, owing to its narrowness, and to the fact that wood walls hold the splashes of manure. The cost of the whole shed was not more than £100, and when cheap accommodation is desired, a shed of this type, but of greater width, is worth consideration.

THE HARPER ADAMS COLLEGE SOILING ROTATION.

1st Crops.

Plot.	Crop.	Seed per Acre.	Time of Sowing.	Time of Cutting.
E	1. Giant Rye ..	2 bush.	20th Sept. ..	8th—31st May.
	Winter Vetches	1 "		
D	2. Giant Rye ..	2 "	4th Feb. ..	1st—12th June.
	Field Peas ..	1 "		
C	3. Winter Oats ..	1 "	28th Sept. ..	13th—30th June.
	Winter Barley	1 "		
D	Winter Vetches	1 "	4th Dec. ..	1st—16th July.
	Wheat ..	2 "		
A	5. Oats ..	2 "	15th April ..	17th July— 1st Aug.
	Field Peas ..	1 "		
H	6. Barley ..	2 "	4th May ..	2nd—16th Aug.
	Field Peas ..	$\frac{1}{2}$ "		
	Vetches ..	$\frac{1}{2}$ "		
	Field Beans ..	$\frac{1}{2}$ "		
	Oats ..	1 "	28th May ..	17th—31st Aug.
G	7. Oats ..	3 "		
	Field Peas ..	1 "	20th May ..	1st—30th Sept.
F	8. Maize ..	$\frac{1}{2}$ "		

2nd Crops.

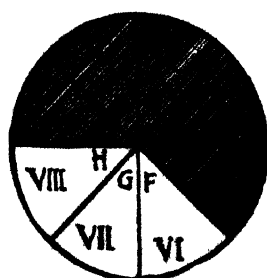
Plot.	Crop.	Time of Planting.	Time of Using.
E ..	9. Cabbage ..	18th June ..	1st Oct.— 16th Feb.
D ..	10. Cabbage ..	26th June ..	
C ..	11. Cabbage ..	6th July ..	
B ..	12. Cabbage ..	20th July ..	
A ..	13. Cabbage ..	5th Aug. ..	

Ten cows were drafted from the College herd and were kept indoors entirely during the summer, except for one hour each day when they were allowed out for exercise. The results of the 1917 test, which have been published, were convincing as regards the economic soundness of the system, and also as regards the far greater possibilities of ploughed land for

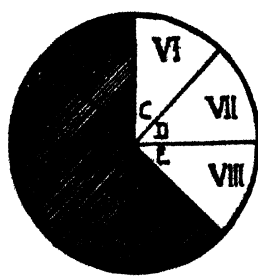
stock farming compared with grass. It was, however, contended by some critics that as the period covered included only the months May to November, the financial results would be influenced by the produce of the cows during the winter months which were not included in this report. The original aim of the test was to ascertain the stock-carrying power of arable land when farmed in this manner, and it had to be admitted that the test should be carried out over a whole year in order to make the financial statement of real value.

The experiment was continued during 1918 with this object in view, arrangements being made to cover a whole year on the system. The same field was used as in 1917, and a field of very poor quality was sown with a mixture of peas and oats to provide hay for the winter months. The rotation of crops adopted was similar to that of 1917, with some improvements. This system worked perfectly with the exception of the maize plot, which failed owing to the war-time seed; there is no safer crop than maize when suitable seed is available.

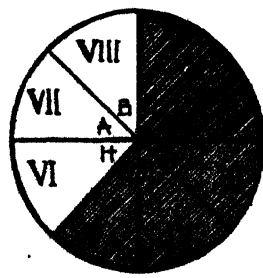
To produce the green fodder for the summer months a field was set apart and divided into eight plots of equal size, each plot producing forage to supply the cows 14 to 21 days. Such an arrangement provides a continuous supply of fresh green fodder throughout the summer. Five of the eight plots were ploughed up and planted with cabbage immediately the first crops were off the ground, the remaining three plots being sown with mixtures in the autumn to provide the first crops for the following year. This plan allows for the same land being cropped continuously on the soiling system; it is illustrated in the following diagrams. Each sector represents



1st Year.



2nd Year.



3rd Year.

a plot, the plots shown by the shading being cropped twice. By this method the crops are alternated to obviate as far as possible the risk of crop-sickness on any of the plots.

Crop Mixtures used.—I. *Rye and Vetches.*—Rye and vetches form a mixture of established value as a fodder crop. It is the only crop available which gives an early cut of forage. In Shropshire, vetches are late in coming to maturity and do not produce any considerable weight before about 20th May. In 1918 one-half of the plot was sown with rye only, a heavier seeding being given, and the other half sown with the mixture of rye and vetches. This proved to be a good arrangement. Rye, although very nutritious in its early stages of growth, very soon becomes hard and unpalatable. When fed alone, after the flowering stage, it is not good fodder, as not only is it difficult to masticate, but it causes a too dry state of the bowels, and the cows do not eat a sufficient quantity. When mixed with vetches, however, this fault is corrected, as the vetches are later than the rye in coming to maturity. Rye has been fed quite successfully up to the time when the straw turns colour, and it is surprising with what relish the cows eat quite hard old rye straw when it is mixed with a quantity of very succulent fodder, such as mangolds, cabbage, immature vetches, or peas. Rye produces milk of excellent quality and does not cause looseness of the bowels.

Rye and Peas.—One of the most difficult periods to provide for is the first half of June. Where Trifolium can be grown successfully this crop might be used, although in Shropshire it has not proved successful. The best mixture available is rye and field peas sown early in February. This mixture has proved quite satisfactory and makes excellent fodder, much relished by the cows. It should be sown as early as possible, otherwise it will not be ready to cut on 1st June. At the time when sowing should take place the land is likely to be too wet for drilling, and in this case the mixture should be sown broadcast immediately after the plough, or ploughed in to a depth of about 3 in. Rapid germination takes place and the plants soon overtake the autumn-sown crops. It is possible that this mixture would give heavier yields if ploughed in in December. Sown in February it gives about two-thirds the yield of rye and vetches sown in September.

Winter Oats, Winter Barley and Winter Vetches.—This mixture is very successful, and when sown late in September is ready to cut about 15th June. It has given very heavy yields—up to 19 tons per acre. Cows will eat large quantities of this fodder, consuming as much as 120 lb. per head per day of the mixture if given an unlimited supply, whereas they will rarely eat more than 80 lb. of rye. A drawback to the barley is

the presence of the awns. These are disliked by the cattle after the ear is past the flowering stage ; the barley grows in advance of the oats, which is an advantage, as the later-maturing oats keep the fodder fresh over a longer period. The crop makes a very dense growth, keeping out light and air from the ground ; it is then practically impossible for weeds to grow underneath. Winter barley is a very reliable crop in Shropshire, a good plant having always been obtained on the experimental plots.

Wheat and Vetches.—This is an unusual mixture, but it has proved successful, giving heavy yields at the right time. Better crops could be obtained by sowing early, but it is deliberately sown late in order that it may be ready to cut at a particular date. Sown late in November, it is necessary to broadcast the seed immediately after the plough. The plant is always rather thin on the ground during the winter and spring, but this gives the vetches an opportunity to branch out, and the wheat also maintains its green condition longer. The cows eat the mixture readily, but they eat a smaller weight than in the case of the barley, oats, and vetches mixture. In 1918 a quantity of field peas sown with this mixture survived the winter. Field peas will live through very hard frost if sown late, so that only about 1 in. of the young plant is above ground during the winter ; sown earlier, however, they are destroyed by the first severe frost.

Peas and Oats.—A mixture of field peas and oats is, perhaps, the best of the crops tried, the long-strawed oats, such as Sandy, being the best suited for the purpose. Two bush. of oats to 1 bush. of field peas appear to be the best proportions for sowing in March or April ; for the later sowing, 3 bush. of oats to 1 of peas are required. The later sowing does not give such heavy yields as the earlier one, and it is hoped that this mixture may be improved on for late sowing. Cattle are very fond of the mixture, either green or made into hay. A drawback to the field pea is its woodiness ; its stems are much less succulent than are those of the garden pea. For this reason garden peas were tried, but proved to be too delicate to compete with the surrounding cereals. Several hybrids have been bred and it is hoped that it will be possible to raise a variety having the hardiness of the field pea and possessing stems free from the excess of fibre which its stems contain.

Barley, Peas, Beans, Vetches and Oats.—This mixture has been grown with considerable success. It is designed to supply green fodder during a period when the crops sown at

the usual time are ripening, and for this reason it tends to cut short its growing period in the effort to produce seed. It provides, however, an abundant yield of forage during August, and several farmers who have seen it, although they have no intentions of adopting the soiling system as a whole, have decided to grow an area of this crop mixture to supplement the failing pastures during August. The crop is broadcasted, and is never drilled, as, being sown out of the ordinary sowing season, it receives the attention of all the grain-eating birds, which have much more difficulty in reaching the seed when it is broadcasted and deposited at uneven depths.

Maize.—Maize yields heavy crops of good fodder during the month of September. For the Shropshire conditions Canadian seed is required; it should be sown between 10th and 20th May, as later sowings do not give such good results. Deep sowing is essential to success. In Shropshire maize, after germination, makes very little growth for about a month, and during this time needs horse-hoeing frequently, as the native weeds of the land make much more rapid growth, and smother the young plants. Rows about 2 ft. apart seem to be best suited to this crop. Much less than $1\frac{1}{2}$ bush. of seed per acre is actually required to produce a crop; the heavy seeding is an insurance against the depredations of rooks and pigeons. Rooks dig up the seed, while pigeons during a spell of dry weather pull off the young succulent leaves of the germinating plants. Some judgment is necessary in feeding green maize; its leaves hold a large quantity of moisture, and if it is fed during a long-continued spell of wet weather, the cows may suffer through being forced to take into the digestive system too great a quantity of water, causing scour and loss of condition. This can be corrected by feeding dry pea and oat hay or pea haulm.

Second Crops.—Five of the eight plots into which the field is divided are ploughed up as soon as possible after the crops have been removed, and planted with cabbage or marrow stem kale. Of the two, cabbage is the better crop, and it will yield almost as heavily as the kale. Cabbage has an important advantage in that varieties can be obtained suitable for different seasons of the year. Sutton's Early Drumhead is suitable for the months of October and November, and Winningstadt and Christmas Drumhead for winter and spring use. A very rapid grower, suitable for late planting, however, has not yet been found. It is necessary to raise the plants in a seed bed and plant out. Planting does not cost more than singling,

and has many advantages. Sowing the seeds of cabbage or marrow stem kale after the forage crops has not proved successful, as the soil is generally too dry to germinate the seeds. It is also necessary to work the soil down to a fine tilth if seed is to be sown, whereas plants can be successfully dibbled into the soil immediately after the plough. Another important advantage which plants have over seedlings is that they have a start over the weeds and need very little cleaning after planting. Much depends on the planting of the second crops in time to produce a full crop before the end of the summer. Large plants are essential; they should be much larger than those usually planted, and it is an advantage if they have thick, succulent stems. Such plants, well planted, will stand a long spell of drought without harm. In 1917 an American tobacco-planting machine was used with success, but skilled workers are needed to operate this machine, in order to get the best results. Where a considerable area is to be planted the machine can be recommended, especially as it gives a dose of water to each plant as it is placed in the ground. Much of the planting of cabbage and kale, in the Harper Adams College experiment, was done by women who were being trained for work on the land, and consequently was very variable in quality, many plants being lost through incorrect planting. The most satisfactory method of planting cabbage after forage crops is to plant immediately after ploughing without giving any other cultivations, and planting into the middle of the furrow slice which contains most moisture. Plants which are planted immediately after the plough take root much sooner than those planted after the ploughed land has been exposed to the air several days. Early Drumhead cabbage are planted 2 ft. apart each way and Winningstadt 2 ft. by 1 ft. 3 in. Drumheads produce the heavier crop, and are suitable for using in the early winter months. They do not stand alternating rain and frost; owing to the flat shape of the head rain easily penetrates it, causing the riper heads to decay. Cabbage with conical heads throw off the rain and resist bad weather conditions more successfully than do the flat-headed types. Cabbage, following forage crops, when large plants are used, require very little after-cultivation; if horse-hoed early and close to the plants, hand-hoeing is not needed at all. Only a small proportion of the cabbage grown as a second crop has been hand-hoed. In cutting the cabbage the ripest heads are selected and used first; this method, although entailing additional trouble,

appears well worth adopting, owing to the very unequal ripening of the cabbage crop.

The Effect of Forage Cropping on the Soil.—The soil of the field on which the soiling experiment has been carried out is a strong loam on the New Red Sandstone formation, and when taken over it was in rather poor condition. It is instructive to note that an adjoining field of old grass land yielded only 15 cwt. of hay per acre. The physical character of the soil has been considerably ameliorated, which is clearly shown by the difference in character between the soil of the treated land and that of the headland which has not been cropped. That soil conditions can be considerably modified by this system of farming is clear, and it is not impossible that even quite strong clays might, in time, be rendered workable when cropped in this manner. The roots of crops such as peas and vetches are undoubtedly soil pulverisers, and do efficiently the work of the cultivator, while they also leave residues of organic matter in the soil. The large quantities of farmyard manure returned to the land have a very noticeable influence on the physical character of the soil after 3 years' treatment. It may be expected that the land will continue to improve for several years, although no doubt the rate of improvement will become slower. The field is very poor in lime and contains several almost barren patches on which treatment has not as yet made any improvement, in spite of applications of specially heavy dressings of farmyard manure and superphosphate to these particular areas. On the rest of the field the fertility has been raised to a high pitch in three years. Soil condition depends very largely on the percentage of humus in the soil; this has been increased from 3.3 per cent. to 4.2 per cent. The improvement of the soil is shown by the following analyses, in which it will be seen that the nitrogen has been raised from 0.122 per cent. to 0.213 per cent.

	1914.	1919.
Moisture	1.38	.84
Loss on Ignition	3.32	4.20
Nitrogen .. .. .	.122	.213
Lime (CaO) .. .. .	.266	.260
Magnesia (MgO) .. .. .	.375	.400
Potash (K ₂ O) .. .. .	.398	—
Phosphoric Acid .. .. .	.100	.105
Calcium Carbonate .. .. .	.087	—

The improvement in the condition of the land is shown in the yields for 1917 and 1918, which may be compared in the table. Some of this increase is, no doubt, due to seasonal

Table showing Improvement in Yield in 1918.

Crop.	1917.		1918.	
	No Manure.	6 cwt. Superphosphate	No Superphosphate	Superphosphate
1 ..	4·841 tons.	7·089 tons.	—	14·8 tons.
2 ..	4·265 "	6·916 "	8·00 tons.	9·64 "
3 ..	2·989 "	2·674 "	12·00 "	13·10 "
4 ..	4·283 "	5·913 "	12·70 "	15·12 "
5 ..	10·976 "	8·599 "	13·50 "	13·50 "
6 ..	2·920 "	9·370 "	8·5 "	7·56 "
7 ..	—	—	8·1 "	8·1 "
8 ..	11·680 "	13·220 "	—	—
Total	41·954 "	53·781 "	62·80 "	81·82 "

influences, but by far the greater part of it is in consequence of the soil improvement brought about by the application of large dressings of farmyard manure. The system produces large quantities of farmyard manure, which is much more effective in crop production than on grass land. The growing of mixtures containing leguminous plants no doubt also adds to the soil fertility, very heavy yields of rye having been obtained when taken after the crop of mixed leguminous plants.

Manuring.—The field used for the soiling crops was in a comparatively low state of fertility at the commencement of the experiment, having had no manure for several years, the crop immediately preceding the soiling crops being wheat. No farmyard manure was given to the first crops, but all the second crops were dressed with dung. For the purpose of testing the effect of artificial manures the field was divided into three plots across the crop plots. Plot I. was dressed with 6 cwt. of superphosphate, and Plot II. with 6 cwt. of superphosphate and $1\frac{1}{2}$ cwt. of sulphate of

A	B	C	D	E	F	G	H
			No Manure.				
			6 cwt. Superphosphate.				
			$1\frac{1}{2}$ cwt. Sulphate of Ammonia.				
			6 cwt. Superphosphate.				
5	4	3	2	1	8	7	6

ammonia; Plot III. was left unmanured, The manures were applied on 23rd March. It will be seen from the results tabulated that the superphosphate gave an average yield of approximately 37 per cent. over the no-manure plot, and that this increase was obtained in the second crop as well as in the first. Sulphate of ammonia gave only a small average increase of yield over the superphosphate plot, which is surprising, considering that the previous crop was a cereal and that the crops 1, 2, 3 and 4 were largely cereal, the leguminous part having been killed out during the winter. The whole of the crops were weighed as they were cut, in each case the superphosphate plot being cut first and the no-manure last. This resulted in the no-manure plot being favoured, as in some cases the cutting of the plot occupied 14 days, during which period the crop was rapidly increasing in weight. To lessen this error most of the plots were cut into two strips. This method was considered superior to making weighings of small measured areas on the same day on each plot.

Table showing Effect of Manures, 1917—Yield per Acre.

	Crop.	No Manure.	6 cwt. Super.	6 cwt. Superphosphate. 1½ cwt. Amm. Sulphate.
1	Giant Rye	4·841 tons	7·089 tons.	7·000 tons.
	Winter Vetches ..			
2	Rye	4·265 "	6·916 "	6·497 "
	Winter Barley ..			
	Winter Vetches ..	2·989 "	2·674 "	5·957 "
3	Winter Oats ..			
	Winter Barley ..	4·283 "	5·913 "	6·674 "
	Winter Vetches ..			
4	Wheat	10·976 "	8·599 "	10·239 "
	Grey Field Pea ..			
5	Oats.. ..	2·920 "	9·370 "	6·120 "
	Field Pea			
6	Vetches	—	—	—
	Oats.. ..			
	Winter Barley ..	—	—	—
7	Beans			
	Winter Barley ..	11·680 "	13·220 "	8·680 "
	Winter Oats ..			
	Vetches	7·520 "	10·260 "	10·520 "
8	Italian Rye-grass ..			
	Alsike	7·100 "	13·380 "	19·340 "
9	Maize			
10	Cabbage	56·574 "	77·421 "	81·027 "
	Cabbage			
	Total	8·082 "	11·06 "	11·576 "
	Average			

Effect of the System on Weeds.—A frequent objection to the Harper Adams College soiling system is that the land is never thoroughly cleaned, as in the four-course practice. The experience of three years of the system, carried out on the same field, shows that this objection is groundless. The land has been given no special cleaning, very little labour having been expended on it in this respect; yet, in spite of this, the land is much more free from weeds than when taken over. Weeds cannot thrive under the close growth of a heavy forage crop, and the land is left perfectly clean when the earlier-sown crops are removed. Late-sown crops have to compete with the summer weeds, and are not quite so effective in destroying them as are the earlier crops. It is quite remarkable that the docks and thistles which were rather abundant in the field when taken over have almost entirely disappeared, without any special effort having been made to destroy them. The secret of this destruction is in the fact that the crop is cut about the time that these weeds are coming into flower, and not only is the root weakened by the cutting, but the ploughing which takes place immediately after turns the root upside down. Coltsfoot and couch grass survive, but do not spread, so that land must first be cleaned of these weeds before it is farmed on this system.

Feeding the Crops.—The success of the system depends very considerably on the manner in which the crops are fed to the cows. In the first place it may be stated that no exact weight can be given as regards the green food required per cow per day, much depending on the size of the cow and the nature of the fodder, and it is necessary to remember, in estimating weights, that, when wet, fodder weighs about 25 per cent. heavier than when dry. The proper quantity to feed can best be gauged by the fullness of the cow; if her sides show no depression she has consumed sufficient for her requirements.

In this experiment cows have kept in good condition and have given high yields of milk when consuming only 70 lb. of fodder per head per day, while it has been found that, in the case of certain crops, they will eat as much as 120 lb. per day. From 80 lb. to 90 lb. seems to be all that is actually required under ordinary circumstances. When fodder is abundant it is advisable to give the cows all they will eat in order that the crop may be converted into manure. The fodder is most relished when it is young and succulent, at which stage it is liable to cause scour during a period of wet weather. Any looseness of the bowels must be immediately corrected,

otherwise the cows will lose condition. The best corrective of this looseness is pea and oat hay, or pea haulm, which is found to be much more effective than meadow hay or cake. The opposite condition may appear if very old fodder is fed to the cows, and there is some risk of impaction when a crop is fed in the ripening stage. This danger may be avoided by feeding with it a head or two of cabbage per day, mixing the old fodder with a quantity of fresh and succulent forage, or by turning the cows out to grass for a few hours.

The crops are arranged in the experiment to cover approximately fortnightly periods, three weeks being about the limit of time that any particular crop can be effectively used. During the feeding period the crop is always changing in nature. The maximum quality never at any time coincides with maximum weight, and the highest feeding value of the crop is reached at a period when it is considerably below its greatest ultimate weight. Experience shows that high quality in the crop must be sacrificed to yield, so as to get the greatest possible returns per acre. It is best to start cutting about the flowering period, and finish before the ripening of the straw has advanced to the yellowing stage. Every effort should be made to keep the moisture in the crop, as it has a much higher value in its fresh state than when wilted. During a spell of very hot, dry weather the forage should be cut in the early morning while the dew is on the crop, and if it is left on the cart and not stirred it will maintain its freshness throughout the day. In the experiment the fodder is cut daily with the scythe, but on a large-scale farm cutting with the mowing machine would reduce labour. An ordinary cart has been used for carting the fodder, but obviously some special design of low-wheeled carriage would be a great improvement in reducing the labour of handling the crop.

During 1918 a quantity of fodder was grown as tonic fodder. It was noticed that the cows kept on the soiling system, even when they were supplied with great quantities of green fodder, would, as soon as let loose from the shed, search for such unusual fodder plants as nettles, docks, etc. This led to the suspicion that, although the fodder crops supplied them were shown to be very nutritious by chemical analyses, they lacked some principle necessary to give entire satisfaction. The value of the small quantity of miscellaneous herbage found in pastures is generally overlooked in the desire to obtain a pasture of the most nutritious grasses, but it is probable that the cow selects from these plants daily, guided by her natural instincts, the

small quantities required to maintain her in health and to give relish to her food. The crops grown for this purpose were sorrel, parsnip-tops, carrot-tops and spinach. These were fed in small quantities with the bulky fodder crops, and apparently gave good results, but the test has not yet been made with sufficient precision for any definite conclusions to be arrived at. Cabbages were fed to the cows during frosty weather without any ill effects; apparently frosted food is not injurious unless fed in too large quantities. During a period of frost the green fodder should be reduced and the dry fodder increased in quantity until all looseness of the bowels disappears. The cabbages were given in the racks, instead of in the troughs, a method which has the advantage of keeping the troughs cleaner than when the cabbages are fed from them. Rock salt is placed in the mangers. It is noticeable that the giving of salt prevents any disagreeable odour arising from the liquid manure during the hot, summer weather. An average quantity of 4 lb. of cake and meal per head per day is allowed throughout the year. Cabbage alone is unsuitable as a fodder for dairy cows, but should be fed with a quantity of some dry fodder, pea and oat hay being used in the College experiment. The quantity of hay required is determined by the weight of cabbage given; cows will eat 1 cwt. of cabbage per day if allowed an unlimited supply, and with this weight will eat only a small quantity of hay. When the allowance of cabbage fell below 80 lb. per day the milk yield began to fall off, and it may be assumed that large dairy cows should be given not less than 80 lb. of green fodder per day during the winter months, if the maximum flow of milk is to be obtained. With this weight of cabbage they will consume about 14 lb. of pea and oat hay, with an average allowance of 4 lb. of cake per day, and will keep in good condition and milk well.

Management of the Cows.—The cows used in the experiment are the commercial dairy Shorthorns of the district, many of them rather old, and past their best as milk yielders. They have now been kept under the system for over two years and are thoroughly settled down to it. At first they were rather restless, the change from the grass not being to their liking. When once they became accustomed to the indoor life they preferred it to grazing out of doors. During the first year of the experiment the cows were allowed out on a closely-grazed pasture for about an hour each day. As this prevented an exact record being kept of the green food consumed, it was discontinued in 1918, and they were only allowed half-an-hour,

twice each day, to obtain water. When there was no pasturage this treatment appeared to be quite satisfactory, and in no way interfered with the health of the cows; apparently very little exercise is required to maintain a dairy cow in health. Keeping the cows indoors did not prevent several of them developing bag trouble during the late summer months.

Inquiries have been made as to whether the calves are born healthy, and if they thrive as well as calves from cows kept under the usual conditions. During 1918 all the calves were kept in loose boxes near the cowshed, and were fed on the fodder crops in the same manner as the cows. They developed particularly well, and were a fine lot, being greatly admired by the many farmers who visited the experiment. It can be claimed that no ill effects appear in the calves as the result of green soiling the cows. In this connection it may be noted that experiments carried out at the Wisconsin University* showed that deformed or ill-nourished calves result from feeding in-calf cows on wheat grain. If wheat products cause this result, it is possible that other foods may cause deformed or weakly calves; the method of feeding adopted at the Harper Adams College, however, has proved quite safe in this respect. Fears have been expressed by several farmers that difficulty would be experienced in getting the cows to hold to the bull, but on the whole there does not appear to be greater difficulty in this matter than with cows kept under ordinary conditions.

The flow of milk depends to a considerable extent on the cow drinking daily a good draught of water; the milk yield falls if she fails to do so. It has been noticed that the cows do not drink if the pond water is very cold, and it seems that an indoor supply should be provided to induce regular habits in this respect. During the first year of the experiment the cows were kept without litter and did not suffer from the want of it, but, in 1918, litter was provided, partly for the purpose of giving greater cohesion to the dung, as without litter it is rather difficult to handle in wet weather.

Quality of Produce.—The quality of the milk obtained under the soiling system is equal to that obtained by pasturing milch cows. Fat tests were made each fortnight during the period of the trial, and the milk from the soiled cows gave a uniformly higher yield than that from the cows on the grass. An objection which has been made to the system is that cheese cannot be made successfully from the milk from soiled cows. To test the correctness of this assertion, several cheeses were made in the College dairy from the milk from the stall-fed cows; the

* University of Wisconsin Agricultural Experimental Station,
Bull. 287, 1918.

yield of curd was good, and the cheese, when used, was found to be of first-rate quality. Rye was remarkable in producing milk from which exceptionally firm butter was made; this characteristic was not apparent in the butter produced from any other forage crop. Only on one occasion was there any suspicion of a taint in the milk, even when the cows were receiving very large quantities of cabbage; this was during a period of warm, moist weather in November. There appears to be no risk whatever of cabbage taint if the fodder is given after milking and the sheds are kept well ventilated.

Yields.—In 1917, 499·4 gallons of milk were obtained per acre against 198·5 gallons from similar land in grass. In 1918, 13 cows were kept on the system for the whole year. They consumed the produce of 7·2 acres of green fodder crops, the estimated produce of 7·18 acres of pea and oat hay, allowing 2·5 tons per acre, and the estimated produce of 1·1 acres of mangolds, allowing a crop of 30 tons per acre. This makes a total of 15·48 acres required to maintain 13 cows for the whole year, cake and litter only being purchased. The yield of milk for the year commencing 9th May, 1918, and ending 8th May, 1919, was 87,369 lb. If milk is taken as having a specific gravity of 1·03, the total annual yield in gallons is 8,482, which averages 652 gallons per cow, and 548 gallons per acre for the land involved. The yields per cow for the year would have been considerably higher but for the fact that half of the cows were late summer calvers. Higher yields per acre could be obtained under better conditions. In the first place the cows are not first rate. Further, owing to the demand for cereals in 1918, a sufficient quantity of pea and oat hay, on which the cows milked particularly well, could not be grown, and during part of the winter the cows were receiving only oat straw and mangolds. Much of the meal given as concentrated food was of poor quality, if high-priced, and when the cows were given crushed oats instead of the purchased meal an immediate improvement in the milk yield took place.

THE CANNING OF FRUIT AND VEGETABLES.

THE preservation of fruit and vegetables by canning has many advantages over bottling, especially when carried out on a commercial scale. The initial outlay is not so heavy, and packing and transport difficulties are much reduced,

while breakages of bottles are avoided, and a great saving of time is effected, as large quantities of produce may be dealt with quickly.

Furthermore, if the canning be carefully done the flavour of canned fruit is considered superior to that of fruit preserved by other methods. This is due to the fact that the cans are hermetically sealed before being sterilised, and all volatile oils and flavours are, therefore, retained.

Apparatus necessary for Canning.—The apparatus necessary for canning by the "water-bath method" depends a great deal upon the quantity of fruit to be dealt with. For ordinary household purposes a large pan fitted with a false bottom can be used, or special sterilising pans holding 18–20 3-lb. cans may be purchased. When using these pans the cans must be submerged in boiling water. If desired, an ordinary copper can be used; in this case it is advisable to obtain the special tin trays with handles which fit into the copper, so that the cans are easily lifted in and out.

Complete outfits of canning apparatus may be bought, and attention may be drawn to the following types:—

The *Royal Home Canner* (Fig. 2) is suitable for domestic purposes and is so constructed as to generate steam quickly. This apparatus will hold three dozen 3-lb. cans at one time. It is portable, and wood, coal or gas may be used to generate the steam.

The *Pressure Canner* is a more complicated apparatus than the *Royal Home Canner*. It generates and retains steam under pressures varying from 5–30 lb. per square inch, and must be fitted with a pressure gauge and safety valve. It enables canning to be carried out very rapidly, and is the only sure method of canning meat, fish, and such vegetables as peas and beans, but is not essential for fruit or tomatoes.

Full particulars of large Commercial or Pressure Canning Outfits may be obtained through the Trade Journals.

Preservation of Food by Sterilisation.—It is a well-known fact that food decay is caused by germs present in the air. These germs are of three classes, two of which, yeasts and moulds, attack both fruit and vegetables, and a third, bacteria, attacks vegetables only.

The destruction of these organisms by heat is known as "sterilisation." If this is properly carried out and reinfection is prevented, food is preserved for an indefinite period.

A temperature of 150° F. to 190° F. is sufficient to kill yeasts and moulds, but bacteria are not destroyed except at a

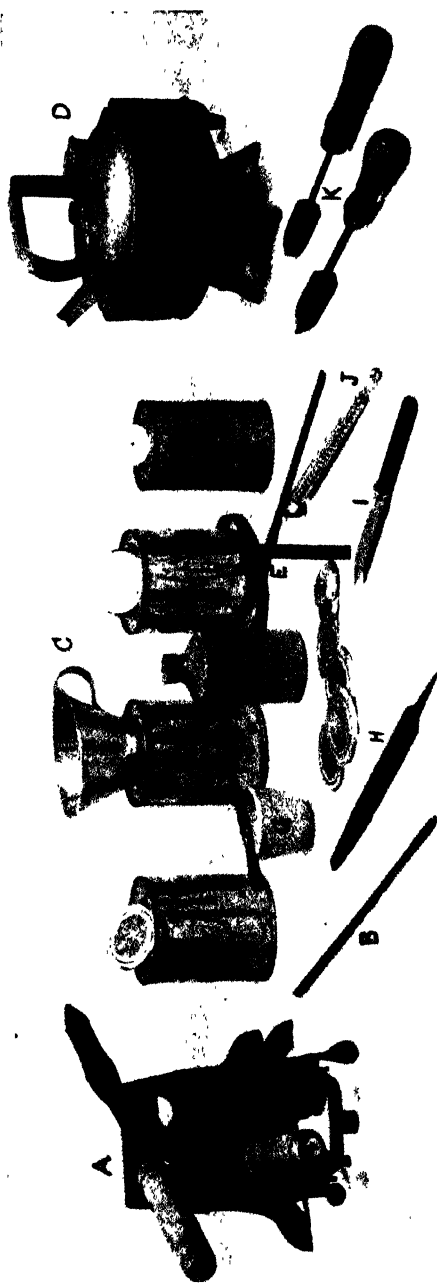


FIG. 1.—EQUIPMENT FOR CANNING. A, soldering iron heater; B, stick of solder; C, cans with caps and funnel for filling purposes; D, kettle to ensure a supply of boiling water; E, can tongs for carrying hot cans; F, jar of flux; G, small basin and brush for using flux; H, fil's; I, knife for preparing the fruit; J, thermometer; K, soldering irons.

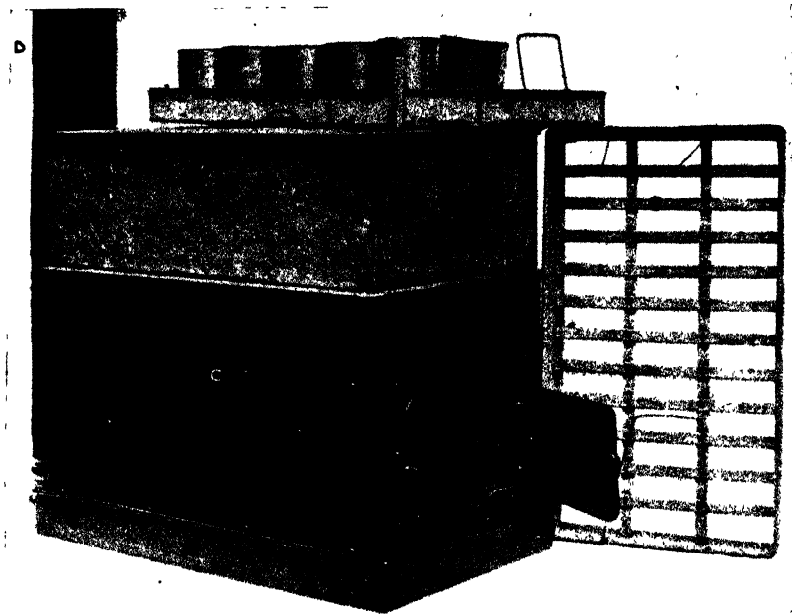


FIG. 2.—THE ROYAL HOME CANNER. Showing the following parts - A, covered boiler or steriliser made of galvanised iron and fitted with handles. B, tray to hold cans. C, japanned iron carrier lined with asbestos. D, chimney to carry off smoke when wood or coal is used as fuel. E, grate for wood fuel etc. F, loose tray in which the canner stands.



FIG. 3.—SOLDERING A CAN. Showing correct position of hands, the soldering iron held in the right hand and stick of solder in the left. A small portion of solder has been dropped on the rim of the cap, and is being drawn round by the hot soldering iron. The stick of solder, meanwhile, holds the cap in position.



FIG. 4.—COMPARISON OF PERFECT AND IMPERFECT CANS. A, perfect can. B, bulged can, showing how the top and bottom of the can has bulged owing to fermentation caused by insufficient sterilisation. B2, burst can, caused by insufficient sterilisation and weak joints in the can—although bursts from the latter cause very seldom occur. C, collapsed can, due to insufficient filling and over-exhaustion.

temperature of 212° F. (boiling point). In each case the temperature must be maintained for the proper length of time.

Equipment Required for Canning (Fig. 1).—Successful canning can only be accomplished if all the equipment is ready to hand before starting. The following are essential:—

1. *Steriliser*.—This may consist of any large pan or boiler, or, better still, a specially made canner.
2. *Cans and Lids*.—The cans are made of tin in nominal 1, 2, 3 and 7-lb. sizes. A reputed 2-lb. can will hold 2 lb. of pulp or jam, but only 1½ lb. of fruit in water; the other sizes are in proportion. Each lid should have a small vent-hole, and cans with wide mouths are the most suitable.
3. *Solder*.—This is used for soldering on the lid and sealing the vent-hole.
4. *Flux and Small Brush*.—Flux or soldering fluid is used for cleansing the tin to ensure that the solder adheres.
5. *Soldering Irons*.—These have copper ends and must be kept smooth and bright.
6. *File and Emery Paper*.—Necessary to clean the irons.
7. *Clean Cloths*.—For wiping the cans, etc.
8. *Boiling Water*.—In plentiful supply.

Preparation of Fruit and Vegetables.—*Grading*.—Vegetables and fruit must be graded carefully according to colour, size and ripeness. This ensures the best “*pack*” and uniformity of flavour and texture to the canned product: these points are very important and should always be kept in mind.

Blanching.—Prior to canning it is very necessary for all vegetables and many kinds of fruits to be “*blanched*.” Thorough cleansing and the removal of acid and acrid flavours are thereby ensured, and the colouring matter sets; the bulk of green vegetables is also reduced, and the splitting and cracking of cherries, damsons and plums are prevented. Peaches and pears are rendered more transparent and given a better texture and more mellow flavour. Soft fruits do not require “*blanching*.”

The operation consists of plunging the vegetables or fruit into boiling water for a time, which may vary from 1 to 15 minutes according to the state of maturity and the kind of fruit and vegetables used.* After the necessary time has elapsed, the fruit or vegetables should be removed from the boiling water and plunged immediately into cold water two or three times, but they should not be left in the cold water to soak. The plunging into cold water sets the colouring matter, and is termed “*Cold-dipping*.” Vegetables are made more crisp if salt is added to the cold water.

* A wire basket or piece of cheese cloth is useful for this purpose.

TABLE FOR BLANCHING VEGETABLES.

Vegetables.	Time of Blanching.
Peas and Beans	2-3 minutes.
Carrots (according to size and age) ..	5-15 ..
Celery (according to thickness) ..	3-5 ..
Beets	5-10 ..
Tomatoes	5-10 .. to loosen the skin.

Filling and Soldering the Cans.—Packing the Cans.—Wash the cans in *boiling* water immediately before filling. Take one can at a time and pack with fruit or vegetables to within $\frac{1}{4}$ in. of the top, but without crushing. To ensure a good “*pack*” the cans should be *weighed*, particularly if the product is for market purposes. Cans after being packed should be dealt with as quickly as possible and not allowed to stand about open.

Adding Water, Syrup or Brine.—Immediately after packing sufficient liquid must be added to cover the produce. Fruit may be canned in either water or syrup, but the latter is to be preferred as it imparts a better flavour to the canned product. For vegetables, brine should be used. The syrup, brine or water used for filling the cans should be boiling (*see* p. 528 for strengths). Next place the lid on the can and wipe dry with a clean cloth.

Soldering on the Lid or Capping.—Apply a little flux with a small soft brush around the groove of the cap, taking care that none enters the can. With the hot iron, well tinned, in the right hand and the solder in the left hand, melt two or three drops of solder round the cap in the groove (Fig. 3). Steady the cap with the stick of solder, but do not cover the vent-hole. Then draw the melted solder round the cap in an even, smooth stream with the hot iron.

Scaling the Vent-hole or Tipping.—If boiling water has been used in filling the cans, then tipping may be done immediately after the lid is soldered on, as enough *air will have been exhausted* or driven out through the vent-hole. To tip a can, place the point of the hot iron over the vent-hole and touch the iron slightly with the solder stick. A bead of solder will then drop on to the vent-hole and make a neat tip. The description of the contents must then be marked on the can with an oil crayon.

Exhaustion.—The operation of *exhaustion* or driving out the air from the cans before “*tipping*” is very important. By

using boiling liquid to fill the cans, and "*capping*" them immediately, the centre of each can will register from 170°–190° F., and sufficient exhaustion then takes place. No can should be tipped below a temperature of 170° F.

When "*tipping*" is not done immediately after "*capping*," and the interior temperature of the can has fallen below 170° F., the air should be exhausted by placing the cans, with the vent-holes open, in the canner for 5–15 minutes until the temperature is brought up again to 170°–190° F. The cans are then removed from the canner and immediately dried and tipped. Great care must be taken if this method is adopted, for by over-exhaustion the cans collapse (Fig. 4 C) on cooling and the contents, although properly sterilised, become mushy.

Sterilisation.—This is the term applied to the process of heating the cans to ensure the destruction of the organisms responsible for decay. The time allowed for sterilising must be reckoned from the moment the water *boils after* the cans have been lowered into the canner. For sterilising in steam, a thermometer is absolutely essential.

TIME TABLE.

Products to be Canned.	Preparation.	Time of Sterilising.
<i>Soft Fruit.</i> —Gooseberries, Currants, Strawberries, Raspberries, Loganberries.	Graded	15–20 mins. at 212° F. (according to ripeness).
<i>Stone Fruit.</i> —Cherries, Plums, Damsons, Apricots and Peaches.	Blanched and cold dipped.	15–20 mins. at 212° F. (according to ripeness).
<i>Hard Fruit.</i> —Apples and Pears.	Peeled, cored and blanched and cold dipped.	20–30 mins. at 212° F. (according to ripeness).
<i>Tomatoes</i>	Scalded and Peeled	20–30 mins. at 212° F.
<i>Vegetables</i>	Blanched and cold dipped.	2 hours. Green vegetables to be redone after 48 hours.

Note.—Very ripe fruit always requires more sterilising than unripe fruit.

Cooling the Cans.—All tinned products must be cooled as quickly as possible to check subsequent cooking, which would otherwise continue for some time, and so spoil the colour and reduce the fruit to pulp. To cool the cans plunge them into a bath of cold water, or, if large numbers are being dealt with, spray them with a hose pipe. The cans must *not* on any account be piled up one on top of the other until *thoroughly* cold. Before storing, the cans should be first dried to prevent rusting, and then lacquered and labelled.

Tinning or Preparation of irons for Soldering.—See that the irons are bright and smooth, and heat thoroughly in a clear fire or over the gas. Place some soldering fluid (flux) in a stone jar for cleaning the irons, and also a small quantity in a clean glass jar for brushing the tins. Dip the irons into the jar of flux and rub the ends with the stick of solder, then immediately dip again into the flux and the solder will be found to run evenly over the iron. This “tinning” is most important, for if the irons are not kept clean and well tinned, the soldering of the cans cannot be carried out successfully. So long as the irons are not made *red hot* they will remain “tinned” and need only be dipped into the flux before using. When once the operator becomes accustomed to the handling of the tools, the soldering may be done very quickly and perfectly. A pound of solder will seal a gross of cans, and an efficient operator can do sixty cans an hour.

Brine and Syrup.—Brine or syrup is made by boiling the correct amounts of salt or sugar in water for ten minutes. All impurities are then skimmed off the top.

For brine, one tablespoonful of salt is required for each quart of water.

The strength of syrup will vary according to the class of fruit to be canned.

- | | | | |
|------------------------------------|--------|----|--|
| 1. Soft Fruit, Plums and Cherries. | Thin | .. | 2½ lb. sugar to each gal. of water. |
| 2. Pears.. .. | Medium | .. | 4½ lb. sugar to each gal. of water. |
| 3. Peaches and Apricots | Heavy | .. | 6½ to 8 lb. sugar to each gal. of water. |

Strawberries and raspberries should be canned in syrup made from the juice of the berries, in which case no water or syrup is used.

Causes of Failure In Canning.—

1. *The Use of unfit Material.*—Fruit and vegetables for canning must be perfectly fresh and in good condition, and must be canned as soon as possible after gathering. Failures known as “Flat Sours” are caused by using material which has fermented or heated through standing for some time. Fruit gathered wet and kept together in too large quantities, or peas remaining in closed baskets or bags are very liable to be spoiled in this manner. The contents of the cans are sour, although there is nothing to indicate this condition until they are opened.

2. *Insufficient Sterilisation*.—Swollen or bulged cans (Fig. 4 B) are usually caused by the produce fermenting through insufficient sterilisation. The ends of the cans become distended with the gas which is generated. The contents are unfit for consumption and have an offensive odour.
3. *Careless Sealing*.—This causes cans to leak and results in the contents going bad. Great care must be taken to detect any leaks before storing, and if found they must be repaired at once. Cans should be tested *after soldering* by lowering each one into a bath of hot water. If a leak is present bubbles will rise to the surface of the water.
4. *Overpacking or Sealing when too cold*.—This also causes bulged cans. If due to overpacking, the cans can be made to resume their normal shape on cooling by pressing in the ends. The contents of the bulged cans due to these causes are quite wholesome.
5. *Shrinkage of Produce in the Cans during Sterilisation*.—This may be caused by—
 1. Improper blanching and cold dipping.
 2. Loose packing through careless grading.
 3. Sterilising too long.
6. *Cloudy Peas* are caused by—
 1. Using peas with cracked skins.
 2. Blanching too long.
 3. Using hard water.
7. *Discoloration of Fruit* is due to—
 1. Careless blanching.
 1. Continued cooking due to piling the cans on top of others before they are cool.
 3. Using over-ripe fruit.

NOTE.—*Rhubarb* should never be canned unless a very heavy syrup is used. Otherwise the lacquer of the cans will not withstand the excessive acidity of the rhubarb and the inside of the tins will rust. The contents of cans in this condition are unfit for consumption.

(This article is also issued separately as Leaflet No. 331.)

THE HARVESTING OF CORN CROPS.

OWING to the comparatively poor yield in many districts, it is this year of great importance that the corn crops of the country should be properly harvested and that there should be no loss of grain due to failure on the part of the farmer to adopt all or any possible means by which such loss may be prevented or lessened. Should the season prove a favourable one in regard to weather, there will be no particular risk, at least to those who have had experience in dealing with corn crops, and the need for special precautions in harvesting will not arise. In this country, however, we can never be certain of having good weather in harvest time, although there are parts of the country, such as the eastern and south-eastern counties of England, with an annual rainfall of not more than about 20 in., that are always freer from weather risk than others. In these dry districts, which are also in the main the corn-growing parts of the country under normal conditions, harvesting is free from many of the difficulties and uncertainties that beset the farmer in the north and west, where the harvest is later and the weather generally less settled. In these wetter districts success in securing the grain in good condition depends to a much greater extent than in dry climates upon the method of handling the crop in the process of harvesting. Certain devices or practices have come to be adopted as a result of experience which have for their special object the prevention or lessening of the damage that is caused to cut corn by bad weather. It may be useful, perhaps, to draw attention to some of these practices as they might, should the weather at harvest happen to be bad, prove advantageous even in districts where there is ordinarily no need for them.

1. **The Field-mow** (Fig. 1).—In several parts of the country where owing to the climate, harvesting is frequently troublesome and tedious it is a common practice in a wet or late season to build small temporary stacks or ricks in the field. These are sometimes known as "field-ricks," "rickles" and "field-mows," and they correspond to "tramp-ricks" or "hillocks" into which hay is sometimes made in the field in wet and late districts.

A field-mow is a miniature stack built on precisely the same principle as an ordinary round stack in a stack-yard and contains generally about an average load or a load-and-a-half of corn. In parts of Wales, where this method is common, an old rule is that a field-mow of wheat should contain 30 8-sheaf stooks, and a mow of barley or oats not less than 20 or more than 25 stooks.

In building a field-mow four sheaves are first of all set up together with the butts well out on the ground and the heads close together. Around these another circle of sheaves is built, the butts of the sheaves

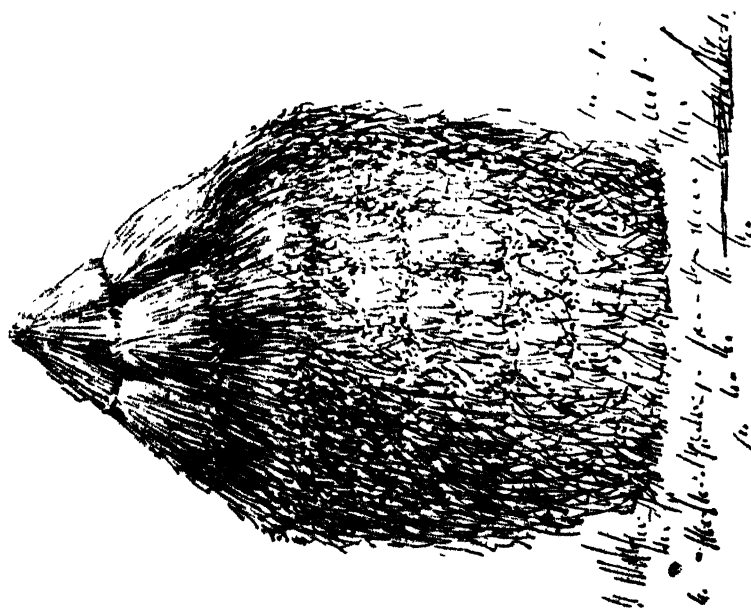


FIG. 1.

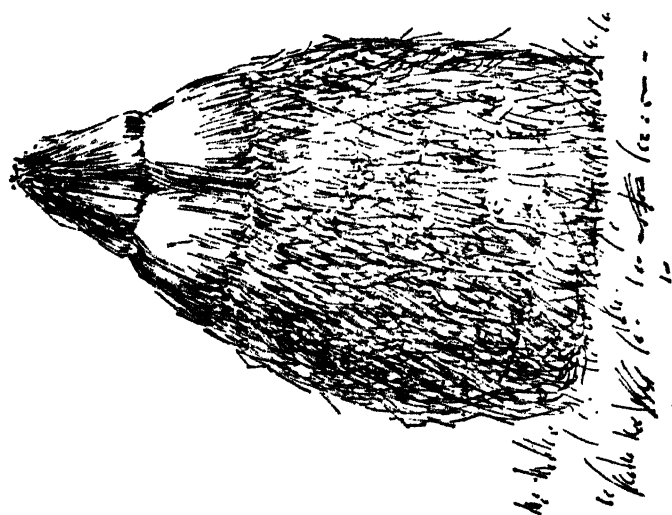


FIG. 2.

resting on the ground. The next course of sheaves is now laid on, the butts projecting slightly over those underneath, each sheaf being, as far as possible, laid on over the space between the two sheaves under it, and firmly pressed under the stacker's knee. Several courses are laid on in the same way, care being taken that the centre of the mow is kept well filled in, so that the sheaves laid in circles around it will all be lying at a considerable angle and not flat. When the mow is about as high as a man's shoulders from the ground, it should be drawn in by fewer sheaves being laid on in the circle and placed at a somewhat greater angle than those in the body of the mow, so that a cone-shaped top may be formed. Four sheaves should be placed on the top with the heads lying close together and the butts spread out somewhat around the cone so as to form a hood or cap over the whole. Sometimes the tops of the four sheaves forming the cap are tied together with a straw band. In all cases, the butts of the sheaves forming the hood should cover the bands of the sheaves lying immediately under them.

In settled weather the corn is not put into field-mows at all, but the great advantage of the system in broken or wet weather is that corn which is partially dried in the stook but which is not dry enough to put into the rick or barn, can be put into field-mows with safety, and will in that way suffer little or no damage from subsequent wet weather, and may be carted home later, having meanwhile dried sufficiently in the mow for stacking. *Corn will keep in mows for weeks in very bad weather where, if left in the stook, it would suffer very severely and even become entirely spoilt.* Where the butts of the sheaves contain much grass or clover, they often dry better in mows than in almost any other way.

The making of field mows certainly involves extra labour, and it requires a certain amount of skill to render the method effective, but the advantages that accrue from adopting this practice in an indifferent season are sufficiently great to warrant the extra labour.

A field-mow may be built very quickly; two men and two women can deal with quite a considerable area in half a day. The sheaves from a certain length of each of two rows of stooks are dragged to the mow by the women. One of the men builds the mow, and the other lifts the sheaves to him.

2. The Hand-mow (Fig. 2).—A smaller mow than that described above, and known as a "hand-mow," or "hand-rick," is made in some places. It is built in a similar way, but contains only from 30 to 50 sheaves, and is generally shaped like a cone, having no "eaves" like the field-mow. These smaller mows are more easily built than the latter, and are mostly found on small farms where normally but few hands are employed in the harvest-field. They are very useful in wet or showery weather, especially if there should be much clover or other green stuff in the butts of the sheaves, but while they have the advantage that it requires less skill and labour to build them, they are not so effective in preserving corn from damage in continuous wet weather as the more substantial field-mows described in the previous section. In building these smaller mows, particular care should be taken to place the sheaves with the side inward that was outside in the stook or shock. In this way full advantage will be taken of the slope that is nearly always found on the butt-end of the sheaf to throw off the water.

If mows are not well built they are liable to be blown down in a high wind. Usually, however, when carefully constructed, only a few of the sheaves forming the "crown" of the mow are displaced. After a storm

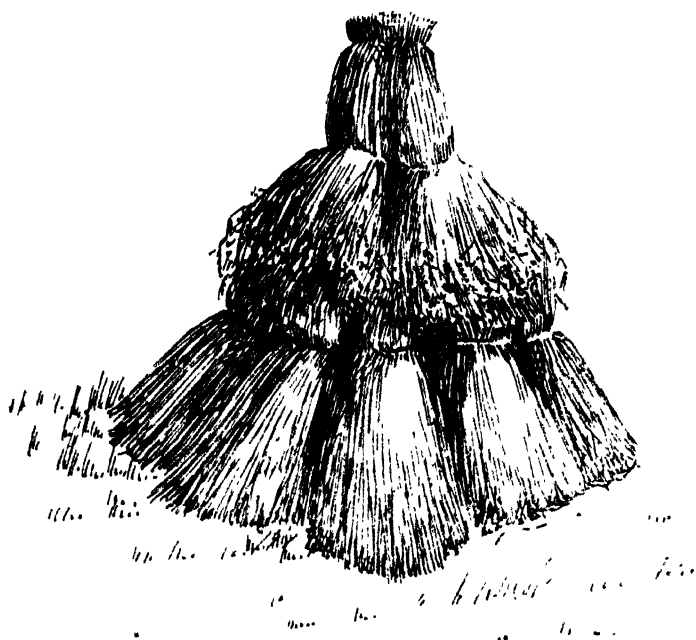


FIG. 3.

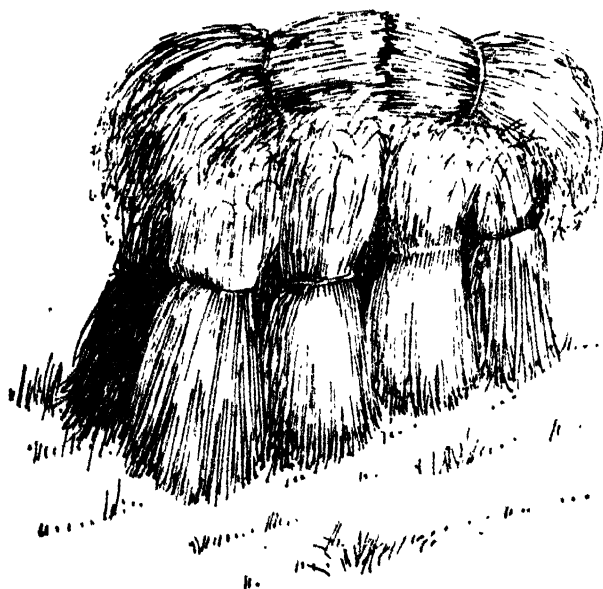


FIG. 4.

it is necessary to go round the mows in the field and replace the sheaves that have been blown down. When the sheaves forming the hood of the mow have been blown down and the top of the mow has become very wet in consequence, it may be necessary to take some of the top sheaves down and rebuild the crown on the original plan.

To prevent the mow from being blown over, two straw ropes are sometimes placed over it diagonally, the ends being fastened with pegs to the ground. The advantage of doing this depends upon the size of the mow; in any case it involves considerable additional labour, and in general is not greatly to be recommended.

3. **The French or "Double" Stook** (Fig. 3).—In parts of France a method of harvesting that is common in bad weather is to make the corn into specially built stooks, which are covered with a hood much like that of a hand-mow. The French stook consists of about a dozen sheaves, which are placed together to form a circular stook, hollow in the middle, and the ears drawn together to a point in the centre. Two sheaves are then placed upside down on the top, and the ears spread all round the stook. The butts of the two sheaves forming the hood are then tied together to keep them in position. It is claimed for this method that it is very effective in keeping the ears dry, and that it also prevents the stooks from being blown down by the wind. The French stook is very similar to the "double stook," which is commonly seen in parts of Ireland.

4. **Hooded Stooks** (Fig. 4).—It was a common practice in parts of this country at one time to "hood" the stooks of oats and barley in the field if the weather was uncertain. Hooding was a very simple operation and consisted in placing two sheaves butt-to-butt on the top of the ordinary 8- or 10-sheaf field stook, with the ears slightly projecting over the ends. No doubt some protection was afforded to the stooks in wet weather by this covering, but the hood and the stooks were easily blown down by the wind.

5. **Pirling** (Fig. 5).—A method of harvesting that is common in parts of the country where corn is normally only grown in small areas is that of making field stooks by setting up two pairs of sheaves, the one pair at right angles to the other, the butts being placed fairly well apart, and the tops of the sheaves tied together about 9 in. from the apex with a band made of a handful of straws drawn from the sheaves. It is simply a 4-sheaf stook tied at the top, and is more or less hollow underneath. This practice is sometimes known as "irling."

Although the tying of the tops in the manner described involves some additional labour, this method of stooking has much to recommend it in a bad harvest and in late districts. Stooks so made dry more quickly than any other kind. They have the further advantage that it takes a great deal of wind to blow them over. In many wet upland districts this is the universal method of stooking and all corn crops are treated in the same way.

6. **Gaiting**.—In parts of the North of England, the corn is sometimes set up in "gatings." A gaiting is a sheaf tied near the top, instead of in the middle, with a straw band, and set up firmly on the ground by spreading the butt so that the sheaf, or gaiting, resembles a bell tent. The centre is more or less hollow, so that the wind blows through. By this method, the whole crop is set up in single sheaves of a special type instead of in stooks. The practice is usually only followed where small areas of corn have to be dealt with. It is claimed for the method that it



FIG. 5.

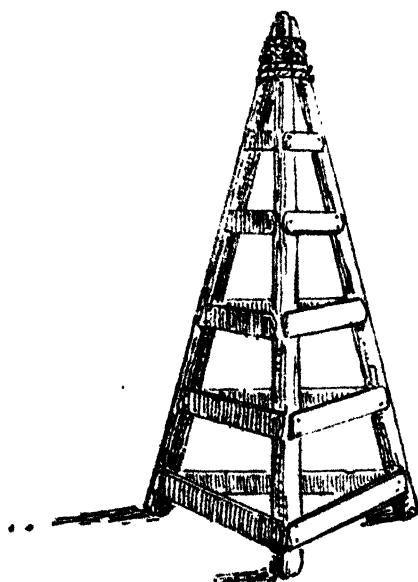


FIG. 6.

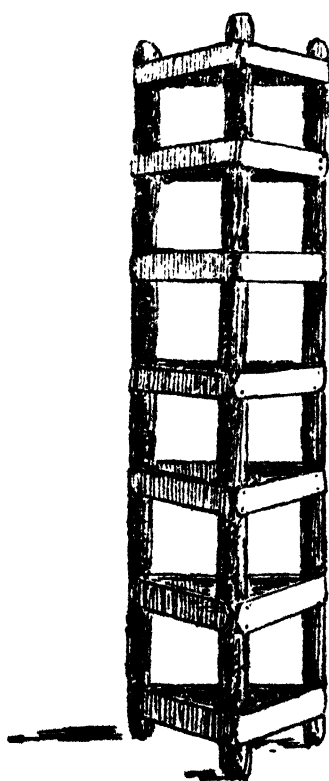


FIG. 7.

is very useful, particularly with oats which contain a large amount of grass or clover.

Any of the above methods may be used with advantage in a wet season, preference being given to the method which can be most conveniently and effectively carried out. The field-mow (1) and the hand-mow (2) have a great deal to recommend them, and are on the whole the methods most to be recommended. The sheaves, however, must have a certain degree of dryness before they can be put into a mow. Once the corn is put into a mow, it is then relatively safe. French stooking, hooding and pirling have advantages in a wet season, but if the weather continues broken over a long spell, none of these is equal to the field-mow for preserving corn from damage, especially in stormy weather.

PROTECTION IN THE STACK.—It frequently happens in a wet season that considerable damage is done to corn in the unfinished stack, or in the finished stack before it can be thatched. Where corn is carted into a shed or barn, damage from rain is avoided, but on most farms, both large and small, corn is stacked in the open, and in wet weather stacking is often a very tedious operation. It is difficult to give here, sufficiently clearly, detailed instructions as to the method of building a stack. Attention may, however, be drawn to certain points in connection with stack-building that are regarded as of special importance in late or wet districts.

1. **Stack- or Rick-stands.**—In most farms where corn is grown in quantity, specially constructed stands of iron or wood and stone called "stools," "staddles" or "stathels," are to be found, upon which the stacks are built. These rise some distance above the ground and answer the double purpose of protecting the bottom of the stack from both wet and vermin and ensuring ventilation. Where no staddles exist on the ground, a bed or stool of straw or hedge clippings should be made. The material should be well shaken, and spread evenly to a thickness of about a foot over the area to be covered by the bottom of the stack. Stacks may be circular or rectangular, the form being largely a matter of local custom.

2. **Ventilators.**—When the corn is not in thoroughly good condition, it is advisable that there should be some arrangement made by which the stack may be ventilated. The commonest method of ensuring ventilation is by placing a "boss" in the centre and building the stack round it. A boss is a structure consisting of three poles or small trees, about 8 or 10 ft. long, tied at the top, and drawn out at the bottom until they stand about 3 ft. apart. They are fastened together by strips of wood placed at intervals and nailed on. When completed a boss of this description will form a three-sided pyramid (Fig. 6). Sometimes, the boss instead of coming to a point at the top, is made in the form of a prism (Fig. 7). At present, as wood is scarce, fewer strips may be used in making the boss than are shown in the illustrations. Straw ropes will answer the purpose equally well provided a few strips of wood are used to give stability to the boss.

A boss placed in the centre of a stack is an effective means of ensuring ventilation, especially if the stack is built on a staddle. At the present time, however, it may be difficult to procure the necessary timber for making bosses, and some other means of ventilating the stack may have to be used. Specially designed stack ventilators have been on the market for many years, but the supply of them is hardly likely to be equal to a large demand.

An old method of ventilating a stack is by placing a bundle of straw, or a sack tightly filled with straw or hay, in the centre of the sheaves which form the foundation of the stack. As the stack rises in height, the bundle or sack is drawn up through the centre to the top, leaving a shaft running from the bottom to the top, and through which a current of air may pass. There is no particular difficulty in making this kind of ventilator, which is quite effective. To enable the cool air to enter the shaft from below, if the stack is built on the ground, a trestle may be placed in the bottom of the stack connecting the outside edge of the stack with the shaft.

3. "**Hearting**" the Stack.—Whatever the shape of the stack, great care should be taken, once the bottom of the stack has been properly and firmly laid and covered with sheaves, to keep the centre well filled in. This is known as "hearting" or "filling." Unless the centre is well filled and kept up as the stack is building, so that the butts of the sheaves slope slightly downwards and outwards, it will be difficult to keep the stack together, and the centre will be lower than the outside when the stack is consolidated, with the result that water may run in. This is the most important part of the operation of stack building, especially in wet districts, or in a wet season.

4. **Size and Shape of the Stack.**—In a wet season, when it is difficult to secure corn under any system in the best condition, it is better to build comparatively small stacks, especially of barley or oats, both of which are more liable to heat than is wheat. A stack consisting of 10 or 12 average cart-loads, or about 10 quarters of corn, will be found a convenient and sufficient size under such circumstances. Where corn contains a considerable quantity of grass or clover, particular care should be taken not to build it into large stacks.

It is a common practice to make the stack swell out somewhat as it proceeds in height, so that the eaves project a foot or even 2 ft. over the base. It is not really necessary that stacks should be built in that way in order to throw off the water, although, in general, it may be said that it is no disadvantage if the stack has been skilfully built.

The top, or roof, of the stack should be fairly steep, so that the rain may run off the more quickly. In forming the top of a stack, special care should be taken to keep the centre well filled in.

5. **Thatching.**—Considerable damage is often caused to grain in the stack. It is important that stacks should be protected as far as possible when the weather is unfavourable, so as to avoid the loss that frequently occurs between the completion of the stack and the time of threshing or thatching. There is sometimes a good deal of delay in thatching which may be due less to negligence than to want of straw until the threshing machine has been round, or to scarcity of labour. For temporary protection, especially of an unfinished stack, stack or rick covers are most useful. For completed stacks which are waiting to be threshed, a few battens of straw on the ridge or crown of the stack, or even a covering of hedge row clippings, will be found useful as a protection should the weather be wet and threshing be delayed. The same method may be adopted as a means of affording temporary protection in the case of stacks that are to be thatched but where thatching cannot be proceeded with at once.

Full details in regard to the method and process of thatching are given in the Board's Leaflet No. 236.

(This article was issued as Food Production Leaflet No. 50 in August, 1919.)

THE Travelling Commission appointed by the Food Controller to investigate locally the cost of milk production in Great Britain and to make recommendations as to the prices to be fixed for milk in the summer and winter of 1919, and also to make enquiries as to the cost of cheese production, have recently issued their Report.*

Report of the Travelling Commission of Inquiry into the Cost of Production of Milk.

Cost of Production.—An Interim Report was issued by the Commission in April and the prices as to milk there recommended were accepted by the Food Controller, and were brought into operation by the Milk (Summer Prices) Order, 1919 (see this *Journal*, May, 1919, p. 198, and June, 1919, p. 325). A further Interim Report has also been issued, dealing with the establishment of differential zones and the estimated cost of production of milk in the summer of 1919 (see this *Journal*, July, 1919, p. 465).

In the Report now issued are given the results of the tabulation of the figures submitted by farmers with regard to the cost per gallon of the production of milk in the periods 1st May to 30th September, 1918, and 1st October, 1918, to 31st January, 1919, which were used by the Commission in framing their recommendations.

It is stated, in regard to *cheese-making*, that there was practical unanimity of opinion that the manufacturing cost was approximately 2d. per lb. in addition to the cost of milk. It was generally accepted that one gallon of milk produced on the average 1 lb. of cheese.

Information obtained as to Methods of Production.—The Commission found that the three main methods of production of milk in Great Britain are :—

1. *Production on Country Farms.*—The most general method of herd management on these farms is to change from a fifth to a third of the herd annually, relying for replenishment on home-bred or purchased stock. Large quantities of home-produced foods are used. By far the largest proportion of the milk produced in Great Britain is produced under these conditions, with slight variations according to the different districts.

2. *Production on Suburban Farms.*—On these farms a larger proportion of the herd is changed annually. Only a small quantity of home-produced food is grown, and consequently artificial feeding stuffs are more largely used. This method of production is found in the immediate neighbourhood of many of the large towns such as London, Glasgow, Birmingham,

* Cmd. 233, 1919, price 2d. net. Published by H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2.

Manchester, and the industrial centres of the North Midlands generally.

3. *Production under the Town Dairy System.*—No home-produced foods are grown by the town dairyman. The cows are kept in all the year round and 75 per cent. to 100 per cent. of the herd is changed annually.

This method of production is chiefly found in Edinburgh, Leith, Dundee, and Liverpool. In the last-mentioned town almost all the producers are also retailers. The town dairy is of importance in that it provides for these towns a supply of milk which they would otherwise have difficulty in obtaining at the present time. The Commission, therefore, in the Interim Report recommended the continuance of the system at present in force by which the Food Commissioner for Scotland is empowered to grant to the town dairmen of Edinburgh, Leith and Dundee special licences to sell at a higher price than the producers' price in the rest of Scotland. It must be admitted, however, that the town dairy is a system which is wasteful of cow-life, and therefore in the long run uneconomic.

Somewhat similar conditions are to be found in the industrial area of the West Riding of Yorkshire, where one of the main forms of agriculture is the production of milk for local consumption, although local conditions such as atmospheric pollution and the high cost of labour render milk production so costly that it does not appear to be a suitable system of farming for the district.

Milk producers in this area have on the recommendation of the Commission been permitted from the 1st May to the 30th December, 1919, to charge for milk a maximum price of 2d. a gallon higher than that prevailing in the rest of England and Wales.

The Commission feels, however, that measures such as those recommended in its Interim Report, are merely palliative and temporary, and that the whole question of milk production in the towns and districts referred to and in parts of Lancashire where somewhat similar conditions prevail, should be made the subject of a special enquiry by the department which is to be responsible for the milk industry in conjunction with the local agricultural and public health authorities with a view to the arranging for a supply of milk to the towns where the town dairy system is now in force from country districts where milk can be produced more cheaply, and the gradual introduction into industrial areas of a system of farming other than milk production.

The Amount of Milk produced in different Periods.—In December, 1918, according to the Report, there were in the whole of England and Wales 1,599,749 cows in milk, which had a total output of 11,875,000 gal. of milk during the week ended 7th December. In June, 1918, the corresponding figures were 1,714,254 cows in milk, producing during a single week 23,340,000 gal. Hence as between June and December there was a decrease of as much as 49.1 per cent. in the output of milk, though there was a decrease of only 9 per cent. in the number of cows in milk. Whereas in June, 1918, the average yield per cow in milk was 13.5 gal., in December, 1918, the yield had fallen to 7.6 gal. per week. The shortage of feeding stuffs, beginning with the gradual reduction in May, 1917, no doubt considerably affected the yield of milk, which was also reduced by the bad quality of the purchased foods.

In December, 1918, 63·4 per cent. out of the total number of dairy cows in England and Wales were in milk, and 36·6 per cent. were dry. This compares with 81 per cent. in milk and 19 per cent. dry in June, 1918. In December, 1917, the census figures showed 60·2 per cent. cows in milk and 39·8 per cent. dry.

Diseases affecting the Milk Supply.—(i.) *Epizootic Abortion.*—The Commission has been impressed during its investigations by the prevalence of this disease and by its serious effect upon the yield of milk. A considerable body of evidence has been received with regard to the use of the Board of Agriculture vaccine, and this evidence was almost without exception favourable. It was found, however, that in many districts the fact that this vaccine could be obtained free of charge was not generally known, and the Commission therefore recommends that farmers should be more widely informed on the subject.*

The Commission was informed at Exeter that this disease has been made compulsorily notifiable by the Devonshire County Council, and that Devonshire is the only county in England in which this action has been taken. The Commission considers that the results of this action call for its extension to the rest of the country, and for the enforcement of the necessary preventive and curative treatment.

(ii.) *Tuberculosis.*—The Commission finds that the use of the tuberculin test as a step in the direction of obtaining a herd free from tuberculosis is comparatively rare, although its value is much more fully realised in some districts than in others. The evidence of veterinary surgeons and of farmers was generally to the effect that herds free from tuberculosis were also less subject to other diseases, and attained a higher standard of health. The Commission feels that there is great need for the further instruction of farmers with regard to this matter, and it is therefore recommended that a scheme should be inaugurated for:—

(i.) The free application of the tuberculin test on an absolutely reliable basis.

(ii.) The production of non-reacting young stock.

The Commission recognises that any such scheme must be introduced gradually in view of the difficulty of obtaining non-reacting animals.

It is considered that the grading of milk is a step in the right direction and should be continued and extended, and that farmers should receive every encouragement to keep non-reacting herds. Further, it is thought that the conditions under which milk is produced in many districts are unsatisfactory in consequence of the lack of hygienic housing accommodation for dairy herds.

(iii.) *Udder Diseases.*—The Commission has also found that diseases of the udder were very prevalent in many districts, and that these diseases were also seriously affecting the yield of milk.

The Commission recommends, with regard to diseases generally, the appointment of a full-time veterinary officer in charge of a county or group of counties, and also the making of grants to the veterinary colleges for the purpose of further research into the diseases of animals.

Labour.—(1.) *Increased Cost and Difficulty of Obtaining.*—The Commission has taken into account, in suggesting maximum producers' prices for the summer of 1919, the effect of the recent increases granted

* A note on treatment for epizootic bovine abortion was published in this *Journal*, June, 1919, p. 340.

by the Agricultural Wages Board on the cost of milk production. The situation with regard to agricultural labour is, however, still uncertain. The unrest in the dairy industry is not due altogether to the scale of wages obtainable, but to the length of the hours worked, and the fact that so much Sunday labour is necessary. It cannot be expected that men and women will work seven days a week if they see any alternative method of obtaining a living. The shorter hours, the weekly rest days, and the higher wages obtainable in factories, have drawn workers from the dairy farms. The statutory half-holiday now in force, though it alleviates the position of the labourers, has increased the farmers' difficulties, since it is necessary in many cases to engage additional hands in order to carry on the work by a system of shifts.

The Commission considers that those farmers who have in recent years sold out their cows, and gone out of the dairying business have, on the whole, done so rather on account of the difficulty of obtaining labour than because the prices fixed for milk were unremunerative.

(ii.) *Employment of Women.*—There would appear to be a distinct opening for the employment of women as milkers in England as is already done in Scotland, and on large farms where accommodation is available and big herds are kept the extended utilisation of female labour would be advantageous.

(iii.) *Use of Milking Machines.*—The Commission received a considerable volume of evidence with regard to the use of milking machines and their value for the saving of labour. The evidence with regard to the efficiency of these machines was conflicting, though there was general agreement that the successful working of a mechanical milking plant depends almost entirely on the operator, who must be rather above the general level of intelligence and reliability.

It appeared from the evidence that the installation of a milking machine led to economy of labour in cases where the buildings were so planned as to permit of a reduction in the number of men employed in the cleaning of the cows and cowsheds.

The general opinion of the farmers as shown by the evidence was that though the results of good hand-milking are preferable to those obtained by the use of a milking machine, the work of the machine is more satisfactory than that of inefficient milkers.

It is recommended that grants should be made either to the Dairy Research Institute or to one of the Dairy Colleges, with a view to further research and experiment in the use of mechanical milkers and to the provision of short courses of instruction for intending operators.

Milk Records.—A general feature of the evidence given was that the yields of milk were on the whole higher in the districts where milk-recording has been carried out to any extent. The Commission therefore strongly recommends the extension of milk recording, and the attempt to improve the milking strain by the elimination from dairy herds of cows showing poor milk records.

Collection and Distribution.—The Commission is impressed with the necessity for the reorganisation of the methods of collection and distribution now generally adopted in the milk industry, and is of opinion that the present heavy loss of milk through souring is unnecessary and avoidable, and that milk of a better quality and of no greater price could be provided were it chilled soon after milking, preferably at the farms, or if this were impossible, at country depots located at centres conveniently

situated for producers and with good railway communication to towns and cities. The following further advantages would arise from the adoption of this policy—

- (i.) *The quantities of milk sent to towns could be regulated according to the daily needs of the retailers.* Under the existing system, while the demand for milk is comparatively uniform throughout the year, the winter supply of milk on many farms is less than 40 per cent. of the summer output. In some cases dealers contract for uniform amounts from the producers, leaving the summer surplus to be dealt with at the farms. In other cases, they purchase all the milk, themselves undertaking to dispose of the surplus. In either case this surplus is a source of anxiety and loss.
- (ii.) *The gross milk production of the country would probably be increased,* as the farmer would be assured of a market for milk produced at all seasons of the year.
- (iii.) *Collection by means of a service of motor lorries could be arranged for,* thus obviating the waste of individual delivery by farmers to stations or retail premises.
- (iv.) *Surplus milk could be dealt with near the source of production,* thus avoiding unnecessary transport and the consequent deterioration of the milk as raw material for manufacture.
- (v.) *It would be possible to arrange for the payment for milk on the basis of the fat content,* which would ensure the giving of a better price for good quality milk.
- (vi.) *It would be possible to arrange for the bacteriological examination of the milk received at the depots from the various farms.* A bacteriological test is considered the most satisfactory method of ascertaining the condition of milk. Under the present system an inspector may be satisfied with the actual condition and arrangement of premises in which milk production is carried on in a very negligent manner, and the inspector's report may therefore be misleading. If a bacteriological test proved the milk to be unsatisfactory the source of contamination could then be further examined. It is thought that it would be possible to train in a comparatively short time assistants capable of conducting a simple bacteriological test, which would be sufficient for the purpose. It would then be possible to combine this method of testing for purity with the inspection of cowhouses as it is carried out at present.

The Commission remarks on the extraordinary variation in the quantities of feeding stuffs, especially fodder and meals, given to dairy cows, and states that there is clearly much room for instruction in the most economical rations for milk production. The Commission is strongly of opinion that a considerable extension of systematic instruction in the feeding and general management of dairy herds is essential to the more economical production of milk and milk products.

MUCH excellent work has been done during the War at many Public Elementary Schools by making the fullest possible use of school gardens and by providing instruction for the children, so enabling them to render valuable service in the production of food. The Board have received a statement of the results obtained at the Rothschild School, Brentford, Middlesex, and it is felt that an account of the work by the Headmaster, Mr. Evan Phillips, may be of interest.

List of Seeds and Produce for 28 Plots, each 40 square yards, 1917-18.

Name of Crop.	Seed supplied.	Crop.	Remarks.
Potatoes—			
(a) Sharpe's Express (Scotch Seed) ..	56 lb.	391 lb.	5 lb. bad seed.
(b) Arran Chief (English Seed) ..	56 lb.	969 lb.	Seed not of good size.
Peas—			
(a) Little Marvel ..	1 quart	92 lb.	—
(b) English Wonder ..	1 quart	114½ lb.	—
Broad Beans—			
(a) Leviathan	1 quart	50½ lb.	Black Aphis very troublesome, especially as on the neighbouring allotments little or nothing was done to keep it in check.
(b) Long Pod	1 quart	48½ lb.	
Dwarf Beans—			
Canadian Wonder ..	1 quart	26 lb.	—
Onions—			
(a) Reading Improved ..	1 oz.	120 lb.	—
(b) Bedford Champion ..	1 oz.	—	—
Parsnips—			
Hollow Crown	1 oz.	138 lb.	—
Turnip—			
Snowball	1 oz.	623 turnips.	—
Carrot—			
James's Intermediate ..	1 oz.	137½ lb.	—
Beet—			
Crimson Ball	1 oz.	420 beet	—
Cabbage—			
Ellam's Early	1 oz.	120 (to Nov. 1st)	Each boy still has two rows Brussels Sprouts, two rows Kale and one row Savoy Cabbage.

Some seven or eight years ago a derelict field was placed at the disposal of the above school by the Middlesex Education Authority. The Secretary of the latter, Mr. B. S. Gott, is

himself keenly interested in gardening and has given great encouragement to the venture in this and other schools, providing every boy with a complete set of the best tools, all necessary seeds, etc., free, the boys themselves taking the entire produce without payment of any kind.

The field itself was rough, uneven, and waterlogged in the lower parts, but with a good south-western slope. The head and two assistant masters were qualified for the work by previous experience and study, having obtained agricultural and horticultural certificates. Two batches of elder boys were selected, 14 in each batch—the maximum permitted by the Board of Education. These went to the field on alternate afternoons, each in charge of its own special teacher.

The waterlogged part of the field was drained by the boys into a pond which lies at the foot of the slope. The higher ground was then planned and divided by paths into two separate sections which were further divided for each team of boys, one rod being allotted to each. The ground was afterwards thoroughly trenched, and the turf inverted and buried. The arrangement of each plot was identical in every case, and the crops varied each year.

During the first winter the plots were left in this condition, and received the benefit of sharp frost, a good seed-bed being thus obtained even in the first season. The results were good beyond expectation and have improved every year. Additional land at the bottom has been reclaimed and each boy was allowed an extra rod or two for potatoes during war-time, the extra seed being bought by the parents, who are one and all keenly interested in the instruction as well as in the crops.

Many old boys have taken up 10-rod allotments let by the Town Council, and have largely benefited by previous instruction as well as by lectures at the school kindly given by the horticultural expert. The regular masters, Messrs. Beazley and Payne, in charge of the school gardens, are now returning from war service, and it is hoped that the scheme will be still more successful and may even be extended.

The following are two examples of papers written by pupils in the botany and gardening classes, and the illustrations shown in Figs. 1 and 2 are reproductions of their drawings—

22nd April.

Hugh Leigh.

The White Dead Nettle. (See Fig. 1.)

Plant.—A perennial herb.

Root.—Fibrous.

Stem.—Upright, square, hollow, hirsute.

Leaves.—Cauline, cordate, serrate, opposite, hirsute, net-veined.

Flower.—Calyx, 5-lobed.

Corolla, 5-lobed.

Stamens, 4 (2 and 2).

Pistil, Stigma—bifid.

Style—long.

Ovary—4-celled.

Order.—Labiata.

Habitat.—In fields, near hedges, and any country spot.

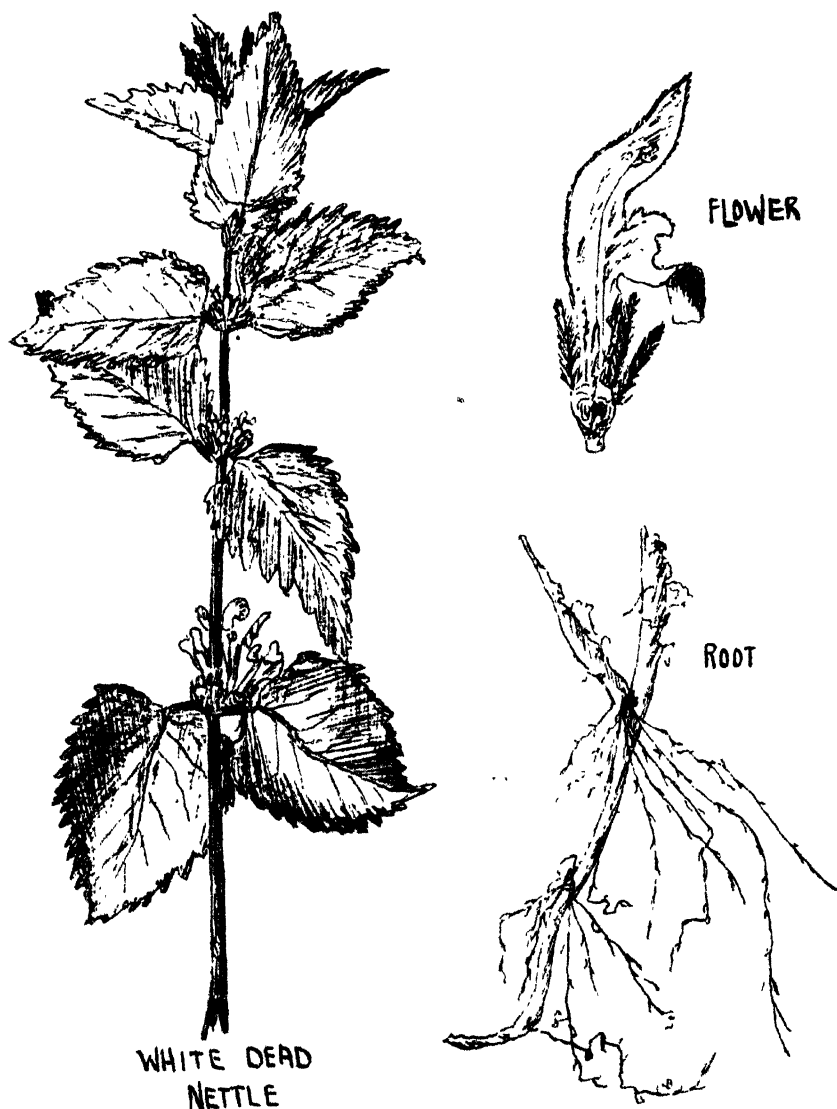


FIG. 1.—The White Dead Nettle.

Botany Stems. (See Fig. 2.)

J. Davis.

1. Those which climb upwards.
 Requiring no support. Stems climb by—
 - i. Aerial roots, *e.g.*, Ivy.
 - ii. Hooks, *e.g.*, Bramble, Goosegrass.
 - iii. Twining, *e.g.*, Runner Bean, Hop, Convolvulus.
 - iv. Sensitive Organs called tendrils, *e.g.*, Pea, Virginia Creeper.
2. Prostrate Stems, *e.g.*, Clover, Strawberry, Creeping Buttercup.
3. Subterranean Stems.
 - A. The Rhizome which creeps along beneath the ground.
 - B. The Tuber, a swollen underground stem, *e.g.*, Potato.
 - C. The Bulb, a modified bud, *e.g.*, Onion, Tulip.

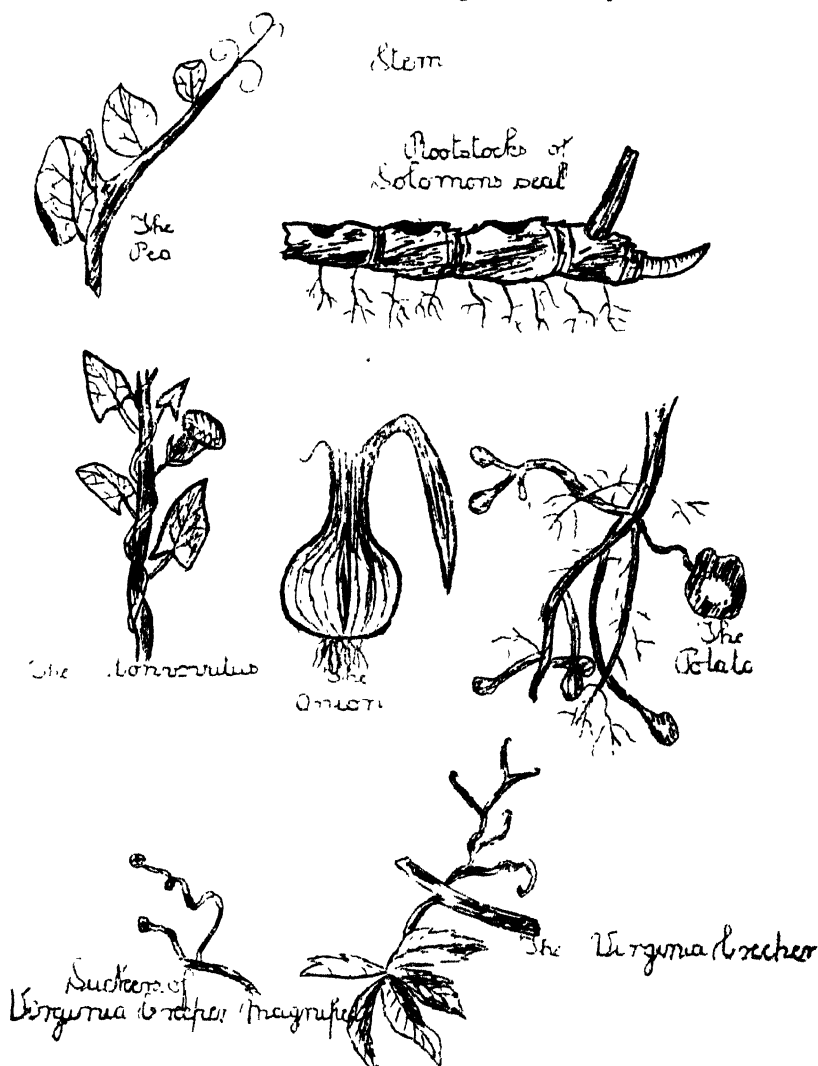


FIG. 2.—Botany Stems.

THE Report for the years 1915, 1916, 1917 and 1918, on the proceedings of the Board under the Tithe, Copyhold, Inclosure and other Acts, dealt with by the Tithe, Copyhold,

Report of Tithe, Commons and Survey Branch of the Land Copyhold, Commons and Survey Branch Division of the Board, has recently been presented to Parliament. (Cmd. 193, price 2d. net.).

1915—1918. The subjects include nearly all those which fell to the charge of the Tithe, Copyhold and Inclosure Commissions, whose functions devolved in 1882 on the Land Commissioners for England and were transferred to the Board of Agriculture on its formation in 1889. With a view to economy during the War, the reports of proceedings under these Acts for the years 1915, 1916, and 1917 were not printed, though a brief summary of the proceedings was inserted in the Board's *Journal* in each of the ensuing years, 1916, 1917, and 1918, respectively.

TITHE ACTS, 1836 TO 1918.

The oldest of the duties with which the Board are charged are those arising from the administration of the Acts relating to tithe rentcharge and other payments in lieu of tithe in kind. The total amount of tithe rentcharge now existing is £3,674,145. Calculated as prescribed by the Tithe Acts, the total value of the tithe rentcharge now payable in England and Wales is £4,012,038, or 43 per cent. more than immediately before the War when the value was £2,798,579.

The amount of tithe rentcharge extinguished by redemption or declaration of merger in 1918 exceeded that for any year since 1913, and was more than double the amount for 1917. This increase was no doubt largely due to the great activity in the property market during the year and is not attributable to the passing of the new Tithe Act, which was only in operation for the last six weeks of the year and at the close of the year had not become sufficiently well known to affect materially the number of applications for redemption actually made during the year. The numerous inquiries received as to the provisions of the Act foreshadowed, however, a considerable increase of redemption business in the new year.

With a view to the release of the maximum possible number of the staff of the Tithe, Copyhold, Commons and Survey Branch for military or naval service, certain classes of the work of the Branch, including compulsory redemptions as against landowners, were suspended during the War, but last year, after the signing of the Armistice, this work was resumed.

If land charged with tithe rentcharge becomes divided in ownership the owner of the tithe rentcharge may call upon the owner of any portion of the land charged to pay the entire rentcharge, leaving him to recover under Section 16 of the Tithe Act, 1842, a due contribution from each of the other landowners concerned, a task which in many instances involves much difficulty and expense. It is also open to the landowner, thus called upon to pay, to make application to the Board for an altered apportionment, fixing a separate rentcharge upon his own property, provided that such altered apportionment would not involve the subdivision of the tithe rentcharge into less amounts than 5s., the minimum sub-division by altered apportionment permitted by the Tithe Acts. It will readily be appreciated that where land is minutely divided, the collection of the tithe rentcharge may not only involve hardship for

certain of the landowners, but may also be a very troublesome and expensive matter for the titheowner. It is understood that in such cases the titheowner often finds it necessary to pay as much as 15 per cent., or even 20 per cent. of the total amount collected as commission to his collector. By the method prescribed by the Tithe Act, 1918, for ascertaining the consideration for redemption at the present time, certain deductions, including one in respect of the cost of collection, are made from the par amount of the tithe rentcharge and the net result is multiplied by 21. As the maximum amount of the deduction allowable for the cost of collection is only $2\frac{1}{2}$ per cent. it is obviously to the interest of the titheowner that he should use all possible means to bring about the redemption of any of his tithe rentcharges the collection of which involves much difficulty and expense.

Where land is charged with a tithe rentcharge of any amount and has been divided since the last apportionment into numerous plots for building or other purposes so that no further apportionment can conveniently be made, application for the redemption of the entire rentcharge may be made under Section 32 of the Tithe Act, 1860, by the owner of any of the plots, or under Section 5 of the Tithe Act, 1878, by the owner of the tithe rentcharge.

Where land is charged with a tithe rentcharge not exceeding 20s., the owner of the tithe rentcharge may apply for its redemption under Section 3 of the Tithe Act, 1878. In cases, however, where the lands of one landowner in the same parish are charged with rentcharges, which severally do not exceed 20s. but which in the aggregate do exceed that sum, the Board will not, as a rule, be prepared to order the redemption of such rentcharges without the landowner's concurrence.

The number of cases of Altered Apportionments of tithe rentcharge completed during the year 1918 was 119 as compared with 282 in 1915, 212 in 1916, and 135 in 1917. The cases completed in 1918 included 18 which were carried out by the Board by their own officers and in which the costs were collected by a rate levied on the landowners concerned.

In these last-mentioned cases tithe rentcharges amounting to £1,100 and charged on 10,742 acres of land were reapportioned among 144 landowners. It may be of interest to note that the total of the expenses assessed among these landowners was £262, the average cost being £16^s. 7s. 4d. per case, £1 16s. 4d. per landowner and 5^s. 1d. per acre.

COPYHOLD ACT, 1894.

The total number of manors affected by the enfranchisement of lands under the Copyhold Acts, with the sanction of the Board or their predecessors, has reached 2,639, the number of transactions involved being 23,455. The gross sum paid for enfranchisement has been £2,788,683, in addition to the creation of rentcharges amounting to £21,490, and the assignment of 1,388 acres of land to the lords for compensation.

INCLOSURE AND COMMONS ACTS, 1845 TO 1899.

Among the transactions completed under these Acts was the Regulation of Winton and Kaber Commons, in the Parishes of Winton and Kaber in the County of Westmorland, under the Commons Act, 1876, by means of an award made by the valuer which was confirmed on the 16th October, 1915.

In the matter of the proposed Regulation of *Coity Wallia Commons* in the County of Glamorgan, protracted negotiations continued throughout the years 1915, 1916, and 1917. Several draft Provisional Orders

were prepared by the Board, but met successively with considerable opposition from the various persons interested, including the four Parish Councils concerned and the Lord of the Manor. A further modified Provisional Order, which it was hoped would meet these objections, was sealed on the 15th January, 1918, and deposited in the locality in the following month, but at the close of the year the promoters of the Regulation had not succeeded in obtaining from the "persons interested" all the consents necessary to enable the Board to proceed further.

After considerable delay the valuer appointed to carry out the Inclosure of the common fields in the Parish of Elmstone Hardwicke (Gloucestershire) was able to submit his draft report and plan for the approval of the Board in 1917. Various objections were raised to the draft report, but these were all ultimately disposed of after an informal local meeting held by an Officer of the Board. The valuer then made his Award, which was confirmed by the Board on the 29th September, 1918, thus completing the proceedings.

IN addition to the provision already made in France for State assistance to farmers resuming cultivation of their land in regions freed from enemy occupation, and also to persons under-

**Assistance to
French
Agriculturists.**

taking the cultivation of abandoned farms in those areas, aid has now been provided for those agriculturists who, in consequence of their own farms being damaged to an extent which renders them incapable of cultivation within a reasonable period, desire to acquire farms which do not come within the second category mentioned above, inasmuch as they cannot be regarded as having been abandoned. A circular letter has, therefore, been sent by the Minister for the Liberated Regions to the prefects of departments affected by military operations, authorising the payment of grants to such persons provided that the land which they propose to acquire lies within a radius of 50 kilometres (about 31 miles) of a damaged commune and is within the liberated zone.

OFFICIAL NOTICES AND CIRCULARS.

N.B.—The Orders which may be mentioned in this section of the JOURNAL may usually be obtained at the price of 1d. each from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, and 28, Abingdon Street, London, S.W. 1; 37, Peter Street, Manchester; and 1, St. Andrew's Crescent, Cardiff.

THE Board of Agriculture and Fisheries have made the necessary arrangements for giving effect to the Government guarantee in respect of the wheat, barley, oats and rye crops of

Claims in respect of 1919.

**the Guaranteed
Prices of Corn.**

The scheme for giving effect to the guarantee is based on the principles of Part I. of the Corn Production Act, 1917, which provides that claims will be payable on the basis of the acreage of corn grown, if the average prices of the crops during the seven months September, 1919, to March, 1920, are less than the guaranteed prices.

The average prices of the various crops are not ascertainable until after the end of March, 1920, and until then it cannot be known whether any payments will become payable under the guarantee or, if they do, what the difference between the average prices and the guaranteed prices will be.

It is consequently necessary that claims should be made in advance so that the corn acreage in respect of which they are made may be properly checked. For this purpose the Board have appointed Corn Claims Inspectors throughout England and Wales to verify during the present summer the acreages on which corn is produced. An Inspector will in due course call upon every farmer growing corn, and will check the acreages entered by him in his annual return. The Inspector will at the same time give each farmer a form of claim, to be filled up by the farmer. If the Inspector is satisfied that the acreage claimed for is correct, and that the land has not been negligently cultivated, he will countersign the claim and send it to the Board, where it will be filed until April, 1920.

If the Inspector is of opinion that there has been negligent cultivation of the land he will refer the claims to the County Agricultural Committee, who will appoint an Assessor to visit the farm and report as to the amount which should be allowed.

The Inspector will give every farmer due notice of the date when he intends to visit the holding, and every facility must be given for inspection.

After his claim has been certified no further action on the part of the farmer will be necessary. Should the average price of any sort of corn be less than the price guaranteed, payment of the amount due will be made by the Board during April and May, 1920.

THE Parliamentary Secretary to the Board stated in the House of Commons on the 14th August that the acreage of land of which the Board have taken possession, and are still in possession under Regulation 2M of the Defence of the Realm Regulations, is 52,180 acres, and of this an area of 31,198 acres is being farmed by agricultural executive committees on the Board's behalf, the remainder being let to farming tenants.

Accounts of receipts and expenditure are rendered to the Board at stated intervals. They cannot yet be published in detail, but a statement will shortly be presented to the House of Commons giving the total expenditure and receipts in relation to the farming of these lands. The policy of the Department, speaking broadly, is to withdraw from possession of lands that the executive committees are themselves cultivating, as soon as they are satisfied that other adequate arrangements can be made for their cultivation. Where the land is suitable for land settlement purposes, the Board hope that the county councils will consider the desirability of acquiring it. Where it is considered expedient to continue in possession after the War has terminated, negotiations will be opened with the owner for a tenancy of the land for the maximum period permitted by the Defence of the Realm (Acquisition of Land) Act, 1916—that is to say for two years after the termination of the War, or, with the consent of the Railway and Canal Commissioners, for a further period of three years.

THE following Circular Letter (Ref. No. C.L. 173/C. 1) was addressed to Agricultural Executive Committees by the Board on 30th June :—

**Land taken under
Defence of the Realm
Regulations :
Circular Letter.**

SIR,—1) The Board have had under consideration the question of the action that should be taken by Agricultural Executive Committees in regard to land of which they have taken possession on behalf of the Board under Regulation 2M of the Defence of the Realm Regulations.

(2) The right of the Board to retain possession of the land *under the Regulation* will cease at the termination of the War, and their continuance in possession will thenceforward be *under the Defence of the Realm (Acquisition of Land) Act, 1916*, but the Board will be able under that Act to exercise in relation to the land all the powers previously exercisable under the Regulation in relation thereto, subject to such conditions as are mentioned in that Act. The terms and conditions of their possession, including rent, will, failing agreement, be in practice determined by a single arbitrator agreed by the parties (see Section 8 of the Act). The retention of possession is limited in certain cases by Sub-sections (2) and (3) of Section 13. The legal position appears to be that the Board's possession under the Regulation, which does not create a tenancy, terminates with the War, and that the terms of the subsequent possession must be agreed or determined by arbitration. Such terms do not necessarily involve the creation of a tenancy, but it would in most cases be desirable that the Board should obtain a tenancy of the land.

(3) In determination of the rent the considerations of paragraph 6 of the Schedule to the Act of 1916 are expressly stated to be applicable, and in some cases paragraph 7 may bear on the question. Those paragraphs are as follows :—

“ 6. In determining the amount of compensation, the value of the land acquired shall be taken to be the value which the land would have had at the date of the notice to treat if it had remained in the condition in which it was at the commencement of the present War, without regard to any enhancement or depreciation in the value which may be attributable directly or indirectly to any buildings, works, or improvements, erected, constructed, or made on, over or under the land, or any adjoining or neighbouring land for purposes connected with the present War wholly or partly at the expense of the State, or, with the consent of the occupying department, at the expense of any person not being a person interested in the land ;

Provided that :—

(a) Where any such building, work or improvement was erected, constructed, or made in pursuance of an agreement with any person interested in the land, the consideration given by such person shall be taken into account in assessing the compensation payable in respect of such interest ;

(b) Where by virtue of an agreement with any Government Department any person interested in the land is entitled as between himself and that Department to the benefit of any such building, work, or improvement, the value attributable to such building, work, or improvement shall be taken into account in assessing the compensation payable in respect of such interest ;

(c) Where, since the commencement of the present War, any person interested in the land has himself erected, constructed,

or made any building, work, or improvement, or has contributed to the expense thereof, or has committed any act depreciating the value of the land, the value attributable to his expenditure or the depreciation in value attributable to such act shall be taken into account in assessing the compensation payable in respect of such interest.

7. In determining the amount of compensation the arbitration tribunal shall also take into account the amount (if any) of any compensation paid or other payment received in respect of the previous occupation of the land so far as such compensation or payment was payable in respect of matters other than the mesne profits of the land."

(4) There will not in these cases be any "notice to treat," but it will be desirable, though not essential, that the owner and any tenant holding under him, whose tenancy has not determined, should receive notice that the Board, or the Committee acting on their behalf, intend to continue in possession of the land after the termination of the War.

(5) The Committee will, as soon as possible, take each case into consideration with a view to a decision as to the period for which possession of the land should be retained. The land of which possession has been taken falls into two principal classes, viz. :

(a) Land which the Committee are farming themselves; and

(b) Land which the Committee have let to farming tenants or for allotments.

(6) With regard to each of these cases the governing consideration will be the interests of food production. In the first class of these cases the Committee should be prepared to withdraw from possession at any suitable time when they are satisfied that satisfactory arrangements will be made for the cultivation of the land in future. The Board suggest that the Committee should consider in the case of each area of land which they are farming themselves, whether the land is likely to be suitable for land settlement purposes. If so, the Committee should bring it to the notice of the Small Holdings Committee of the County Council in order that they may consider whether it should be acquired by them under the Small Holdings and Allotments Act, 1908. With regard to land which is unsuitable for settlement purposes the Committee should inform the Board whether they consider it desirable to remain in possession or not. If the Committee recommend that they should withdraw from possession, they should, after obtaining the Board's approval, notify the owner and any tenant of the land of their intention and state the date on which they propose to withdraw. It will be convenient as a general rule that withdrawal should take place at the usual date in the district for the termination of tenancies, and that three months' previous notice of withdrawal should be given to the owner and tenant.

(7) With regard to land which has been let to farming tenants or for allotments the Committee should endeavour to arrange that the owner of the land should take over the tenancies, and if he agrees to do so the Committee should withdraw from possession.

(8) In any case in which possession is retained the Committee should inform the owner and any tenant of the land that the Board intend to retain possession under the Defence of the Realm (Acquisition of Land) Act, 1916, and should offer to negotiate the terms and conditions of such continued possession on the lines indicated in paragraphs 3 and 9 of the Circular.

(9) The negotiation as to the rent and conditions must naturally aim at arriving at the probable rent and conditions that an arbitrator would award, and the rent offered should, as a general rule, be the post-war annual value of the land in the condition in which it was at the time of entry by the Board. As regards tenure, it would be well to provide for a continuance of possession until the usual half-yearly date next before the expiration of two years from the termination of the War, and if the Board obtain the Railway and Canal Commissioners' consent to their further continuance of possession, then before the expiration of the period allowed by the Commissioners; but possession should be determinable by the Board by six months' notice expiring on the date usually adopted in the district for expiration of tenancies.

Any arrangement arrived at must be expressly subject to the approval of the Board.

(10) It will be observed that the provisions of the Act are based on the assumption that the improvements effected by the Government Department are not paid for by the persons interested in the land, and they are not altogether appropriate to cases under Regulation 2M, where the cost of works of cultivation and adaptation are recoverable under Sub-section (4) of the Regulation. The general effect seems to be that the Board will be liable to pay an unimproved rent and be entitled to recover the value of their improvements when their tenancy ends, but this should be made clear in the adjustment of the conditions of their extended possession.

(11) Where possible the Committee should at the same time arrive at a provisional settlement of all outstanding claims for compensation for the possession of the land by the Board up to the termination of the War.

(12) Where a Committee are in possession of any common land or open space, or of an allotment set out for any public purpose under an Inclosure Act or award, the Committee should refer the case in the first instance to the Board, as there are special provisions in the Act of 1916, and also exceptional considerations, applicable to the retention of possession of such lands.

(13) The powers of the Act of 1916 are conferred on the Board as the "occupying department," but while the Board remain in possession under the Act they will be able, as stated above, to exercise the power now conferred on them by paragraph (6) of Regulation 2M and to authorise a Committee to exercise on their behalf their powers in relation to the land. This power of delegation the Board will exercise so as to enable one Committee to deal with these matters and the administration of the Corn Production Act, 1917, and in the meantime your Committee are requested to proceed in the manner indicated in this Circular.

I am, etc.,

(Signed) F. L. C. FLOOD,
Assistant Secretary.

THE following Circular Letter (No. C.L. 181/C.6) was addressed to the London County Council and the Councils of Boroughs and Urban Districts in England and Wales by the Board

War Allotments. on 11th July:—

SIR,—(1) I am directed by the President of the Board of Agriculture and Fisheries to refer to the Board's Circular Letter, 158/66, of the 23rd May last,* and to say that cases have been

brought to the notice of the Board where Local Authorities have given allotment holders unnecessarily short notice to quit, where land has had to be relinquished for building or industrial purposes. The Board realise that in certain circumstances land is required to be utilised immediately for these purposes, and that any delay in the Local Authority withdrawing from such land might conceivably expose the Board to the liability for heavy compensation. They are of opinion, however, that such cases are relatively few in number, especially in view of the difficulties which at present exist in arranging for the erection of buildings. The Board hope, therefore, that in every case when it is decided that land used for allotments must be given up, the Local Authority will endeavour to arrange with the owner that the allotment holders should remain in possession until the present growing crops are cleared. Great dissatisfaction is caused when allotment holders are displaced and no use is made of the land for several weeks or even months, even though the allotment holders may be adequately compensated for the direct loss they have suffered.

(2) The President desires to call the special attention of Local Authorities to the necessity of making every endeavour to provide dispossessed allotment holders with alternative plots. The duty of providing allotments has been placed upon Local Authorities by Parliament (*vide* Small Holdings and Allotments Act, 1908), and the fact that war plots have been cultivated in any district during the last two years, and that the cultivators have been dispossessed, is in itself evidence that the number of allotments provided under the Small Holdings and Allotments Act is inadequate. In every such case, therefore, it is the duty of the Local Authority to acquire land whenever it can be obtained on reasonable terms, so as to satisfy the demand of dispossessed allotment holders and other applicants who are desirous and capable of undertaking its cultivation. The powers of Local Authorities to acquire such land compulsorily will be very materially increased when the Land Settlement (Facilities) Bill, now before Parliament, has become law; but the Board desire to impress upon all allotment authorities that even under the existing law they have wide powers for the provision of allotments for all holders of war plots who may be dispossessed.

(3) I am also to draw the attention of your Authority to the question of the rent which should be offered to owners for the use as allotments after the termination of the War of land entered upon under Regulation 2L, of which possession is retained by the Board under the Defence of the Realm (Acquisition of Land) Act, 1916. Section 1 (3) of the Act in effect provides that in determining a rent the basis of the assessment should be the value that the land would have had at the termination of the War if it had remained in the same condition as it was at the date of the entry under Regulation 2L. In the case of vacant building sites a nominal rent might be offered in the first instance, and in no such case should the sum offered exceed the rental value which the land would have commanded for allotment or other agricultural purposes, if the land had remained in its original condition.

(4) The Board would be glad if your Authority would arrange to proceed as rapidly as possible with the necessary negotiations for the continued use as allotments of land entered upon under 2L with a view to the submission to the Board at an early date of the proposed terms and conditions of the Board's continuance of possession (see para. 11 of Circular Letter of 21st February last, C.L. 122/C2.)*

* Printed in this *Journal*, March, 1919, p. 1520.

(5) The Board are advised that it was necessary to make a new Order empowering Local Authorities to act as the agents of the Board for the purpose of carrying on their existing allotment duties in respect of land of which the Board continue in possession under the Defence of the Realm (Acquisition of Land) Act, 1916. They have accordingly made the Cultivation of Lands (Allotments) Order, 1919, of which a copy is enclosed* for the information of your Authority.

I am, etc.,

(Signed) A. D. HALL.

ENCLOSURE.

WHEREAS the Board of Agriculture and Fisheries under the powers conferred by Regulation 21. of the Defence of the Realm Regulations, acting on their own behalf or through a local authority, have taken possession of divers lands and are in possession of the same ;

And whereas under Section 1 of the Defence of the Realm (Acquisition of Land) Act, 1916, the Board is, after the termination of the present War, entitled to continue in possession for such period as therein mentioned of the lands hereinbefore referred to, and whilst any land so continues in possession of the Board the Board may exercise in relation thereto all such powers as were during the continuance of the War exercisable in relation thereto under Regulation 21., subject as in the said Act provided ;

And whereas by divers Orders made under the power in that behalf contained in Regulation 21. the Board have authorised certain local authorities to exercise on behalf of the Board the powers conferred by that Regulation as respects the lands referred to in such Orders, subject nevertheless to the provisions of such orders ;

Now the Board of Agriculture and Fisheries do hereby order and declare as follows :—

1. From and after the termination of the present War any local authority authorised by any such Order as aforesaid to exercise on behalf of the Board the powers conferred by Regulation 21. in respect of any land is hereby authorised with a view to maintaining the food supply of the country to exercise on behalf of the Board in respect of such land in any case where the Board continue in possession thereof after the termination of the present War all such powers as are set out in the Schedule to this Order, subject to the restrictions and conditions contained in that Schedule.

2. This Order may be cited as the Cultivation of Lands (Allotments) Order, 1919.

Schedule.

(1) A local authority may, subject as hereinafter provided, cultivate the land or use the land (including any buildings or erections thereon) for the keeping or breeding of livestock, poultry or bees, or arrange for its cultivation or use as aforesaid by any person either under a contract of tenancy or otherwise.

(2) A local authority may, subject as hereinafter provided, do or authorise to be done on the land all things which they consider necessary or desirable for the purpose of the cultivation of the land or its use as aforesaid or for adapting the land for cultivation or such use as aforesaid,

* See below.

including the erection of fences or buildings, and may also subject to the provisions of the Defence of the Realm (Acquisition of Land) Act, 1916, remove any such fence, building or other work erected or constructed under the powers conferred by Regulation 2L, or under this provision.

(3) A local authority shall not use or arrange for the use of any land for the keeping or breeding of livestock without the sanction of the Board.

(4) A local authority may arrange with any society having for its object the cultivation of vacant land for the cultivation or use of the land, and may delegate to such society such of the powers of the local authority under this Order as may be necessary for the purposes of the arrangement.

(5) A local authority shall, as far as practicable, arrange that the payments made by the occupiers for the use of the land shall cover the cost incurred by the local authority on behalf of the Board in providing the land or adapting it for cultivation or use.

(6) An arrangement with a person or society for the cultivation or use of the land shall be subject to determination by the local authority or the Board at any time by notice to the person or society, and shall not provide for payment of compensation to that person or society in excess of the value at the time of quitting of the crops growing on the land and the labour expended upon and manure applied to the land in anticipation of a future crop.

(7) The land shall not be authorised by the local authority to be used for the production of vegetable crops which continue productive for more than one year.

(8) A separate account shall be kept by the local authority of all its receipts and expenditure under this Order, which shall at any time be open to inspection by an officer of the Board,

Prices of Home Manufactured Cakes and Meals.

THE Ministry of Food have made arrangements with the manufacturers for home-produced cakes and meals to be available to farmers at the following prices *ex mill* :—

Cakes and Meals.—		<i>Price per Ton ex Mill to Farmer.</i>
Linseed Cake containing from 8 to 10 per cent. oil .. .. .	.. .. .	£25.
Cotton Seed Cake (black) .. .. .	.. .. .	£20.
" " (white) .. .. .	.. .. .	£19 10s.
Palm Kernel .. (in bulk) .. .. .	.. .. .	£17.
Extracted Palm Kernel Meal (in bags, gross weight) .. .. .	.. .. .	£17.
Ground Nut Cake, decorticated .. .. .	.. .. .	£24.
" " semi-decorticated .. .. .	.. .. .	£22.
" " undecorticated .. .. .	.. .. .	£21.
Soya Cake .. .. .	.. .. .	£25.
Extracted Soya Meal (in bags, gross weight)	.. .. .	£25.
Coconut Cake (in bulk) .. .. .	.. .. .	£21.

Cakes and Meals.—cont.*Price per Ton ex
Mill to Farmer.*

Rape Cake	£18.
Extracted Rape Meal (in bags, gross weight)	£18.
Sesame Cake	£23 10s. 0d.

Note.—The above prices are net cash per ton *ex mill*, Hull, London, Bristol, and Liverpool. All distributing commissions to intermediaries are to be included in the price. Outlying and distant mills may charge extra prices, the difference not to exceed 10s. per ton. The maximum price for nutting and kibbling is to be 10s. per ton, for grinding £1 per ton.

Compound Cakes and Meals.—The maximum prices for compound cakes and meals will be as follows :—

Compound Cakes.—*Price per Ton.*

Cake and meals containing not less than 8 per cent. oil and not less than 20 per cent. albuminoids	£23.
Cakes and meals containing less than 8 per cent. oil and less than 20 per cent. of albuminoids, to be sold at a reduction of 7s. 6d. per unit of both oil and albuminoids.	

Pig Meal.—

Pig meal containing not less than 5 per cent. oil and 15 per cent. albuminoids ..	£20.
Pig Meal containing less than 5 per cent. oil and 15 per cent. albuminoids to be sold at a reduction of 7s. 6d. per unit of both oil and albuminoids	£20.

Note.—The prices for compound cakes and meals and pig meal are net cash per ton gross weight, bags included *ex mill*, Hull, London, and Liverpool. All distributing commissions to intermediaries are to be included in the price. Outlying and distant mills, including Bristol, may charge extra prices, not to exceed 10s.

It will be remembered that an arrangement was made, with makers, at the beginning of June, whereby 5,000 tons of Sulphate of Ammonia at £17 per ton were to be reserved to meet

Sulphate of Ammonia. immediate demands for this fertiliser for direct application.* This quantity has now been sold and the makers are now offering to supply any additional quantities at £19 10s. per ton.

It is now becoming recognised that the policy of offering rewards for the destruction of rats is unsatisfactory and that the expenses incurred by the Local Authority should be

Destruction of Rats. more equitably borne by the persons on whose premises the rats are destroyed. The first Local Authority to adopt this principle in drawing up a scheme is the Herefordshire Agricultural Executive Committee. This Committee has engaged a professional rat catcher at a salary of £5 per week and actual out-of-pocket travelling expenses, and proposes to deal with the county by a district at a time. Where an occupier will not pay his share of the expenses the Committee proposes to serve him with a notice and to

* See this *Journal* for June, 1919, p. 335.

charge him with the whole of the expenses as allowed under the Destruction of Rats Order. Up to the present the receipts of the rat catcher have equalled the expenditure, and no actual cost has, therefore, fallen upon the county. It is intended to deal with the whole of the county on this basis, taking various districts and working them right out. The Board are following the scheme with interest, and they hope that the results will serve to encourage other Local Authorities to adopt the same course.

THE Food Controller has issued a Notice (No. 848) under the British Cheese Order, 1917,* fixing the maximum first-hand prices of certain varieties of cheese. The prices per lb., in so far as they apply to England and Wales, are as follows:—

Variety of Cheeses.	For Delivery on or before 31st October, 1919.					
	Manu- factured before 1st May, 1919.	Manufactured between				
		1st and 31st May, 1919 (inclusive).	1st and 30th June, 1919 (inclusive).	1st and 31st July, 1919 (inclusive).	1st and 31st August, 1919 (inclusive).	1st and 30th Sept., 1919 (inclusive).
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Ripened Stilton and Wensleydale (blue) ..	1 10	1 8	1 7	2 2	2 0	2 2
Dorset hand-skimmed (blue)	1 4½	1 2½	1 1½	1 8½	1 6½	1 8½
Dorset separated (blue) ..	1 0½	0 10½	0 9½	1 4½	1 2½	1 4½
Dorset separated (white) ..	0 11	0 9	0 8	1 3	1 1	1 3
All other whole-milk cheese (except Caerphilly cheese and any whole-milk cheese not exceeding 2 lb. (weight uncut))	1 8	1 6	1 5	2 0	1 10	2 0
All other partially skimmed cheese (i.e., cheese containing at least 25 per cent. of fat in the dry matter) ..	1 2½	1 0½	0 11½	1 6½	1 4½	1 6½
All other wholly skimmed cheese (i.e., cheese containing less than 25 per cent. of fat in the dry matter) ..	0 11	0 9	0 8	1 3	1 1	1 3

* See this *Journal*, November, 1917, p. 910, and January, 1918, p. 1140.

<i>Variety of Cheeses.</i>	<i>Delivered between</i>	
	<i>9th August and 8th September, 1919 (inclusive).</i>	<i>9th September and 8th October, 1919 (inclusive).</i>
	<i>s. d.</i>	<i>s. d.</i>
Any whole-milk cheese not exceeding 2 lb. weight uncut, other than Caerphilly	2 0	2 2

In all cases prices are *ex* factory or *ex* farm. All these prices are subject to the following terms:—

For cash within 7 days .. 2*d.* in the $\frac{1}{2}$ discount.

For cash within 1 month .. 1*d.* in the $\frac{1}{2}$ discount.

THE Board have issued the "Conveyance of Live Poultry Order of 1919," to operate on 16th September. The chief aims of this Order

Conveyance of Live Poultry.

are to protect live poultry in transit from needless cruelty, and to improve the hygienic conditions under which live poultry are conveyed. In future, poultry in transit must be protected so far as is practicable from exposure to bad weather or sea water or excessive heat; they must be forwarded in suitable baskets or boxes or other packages, and these packages must not be overcrowded or stored in places insufficiently ventilated. The shipping company and the master of the vessel, or the railway company conveying the poultry are held responsible for the carrying out of the conditions laid down in the Order.

Provisions are also made in the Order to safe guard live poultry during conveyance by road or exposure for sale. For example, birds must not be unnecessarily tied by the legs or be allowed to remain so tied for a longer period than is necessary, nor must they be unnecessarily carried head downwards. Whether the poultry are being sent by water, by rail or road, they must be forwarded in a receptacle of sufficient size and so made that the heads, legs, or wings of the birds will not be injured through protrusion from the top or bottom or sides.

Mixed consignments of live poultry may not be sent huddled together indiscriminately in the future as they have been in the past. For example, turkeys, geese, and ducks, if forwarded in the same receptacle with other live poultry, must be separated from them by an effective partition. Reasonable care, moreover, is insisted upon in the lifting, carrying, and depositing of consignments of live poultry. They must not be confined longer than is necessary during conveyance; in exceptional circumstances of delay they must be fed and watered during transit.

An important provision of the Order from the point of view of the general public, and especially of the buyer of live poultry, deals with the question of the regular cleansing of the receptacles in which the poultry are forwarded. "A receptacle which has been used for the conveyance of poultry by land or water to any place in Great Britain shall be thoroughly cleansed by the owner or person in charge thereof before being again so used, and if sent by railway or vessel before being so sent."

In isolated cases a certain inconvenience may be caused to members of the trade by one or other of the provisions of the Order, but there is no doubt that generally the trade, in common with the larger public,

will benefit in proportion to the thoroughness with which the Order is carried out. The Board of Agriculture appeal with confidence to the general public, the poultry trade, and the poultry Press, to assist in every possible way in carrying out the Order.

AN Order, dated 8th July, 1919, has been issued by the Agricultural Wages Board, varying the minimum rates of wages for female workers.

The main provisions are set out below:—

**Rates of Wages for
Female Workers.**

1. The minimum and overtime rates of wages for female workers of 18 years of age and over throughout England and Wales shall be as from 14th July, 1919, as follows:—

Area.	Minimum Rate per Hour.	Overtime Rates per Hour.	
		On Week-days.	On Sundays.
In Cumberland, Westmorland, York- shire and the Furness District of Lancashire	7d.	9d.	10½d.
In all other parts of England and Wales	6d.	7½d.	9d.

2. Provided that during the first three months of a worker's employment in agriculture the minimum and overtime hourly rates set out in Clause 1 above shall be subject in each case to a deduction of ½d. an hour

3. For the purposes of the above rates the following employment is defined as overtime employment, that is to say:—

(1) In all parts of England and Wales.

(a) All employment on a Sunday.

(b) All employment on a week-day before the hour of 7 a.m. or after the hour of 5 p.m.

(c) All employment in excess of 6½ hours on a Saturday or on such other day (not being Sunday) in every week as may be agreed between the employer and the worker.

(2) In the areas hereinafter mentioned (being the areas of the District Wages Committees established by minutes of the Agricultural Wages Board), all employment on a week-day in excess of the number of hours hereinafter specified, that is to say:

(a) In the Cambridgeshire, Huntingdonshire, and Bedfordshire, Cumberland and Westmorland; Derbyshire; Devonshire; Dorset; Hertfordshire and Middlesex; Kent; Northamptonshire; Nottinghamshire and Wiltshire areas—in excess of 8½ hours in summer and of 8 hours in winter.

(b) In the Cheshire, Lancashire, Shropshire, Glamorgan and Monmouth, and Merioneth and Montgomery areas—in excess of 8½ hours all the year round.

(c) In all other areas—in excess of 8 hours all the year round.

Notes.—It will be observed that the weekly rates previously in force for regular workers in Northumberland are now cancelled, and that all female workers are in future to be paid the hourly rates set out above. For the full legally binding provisions of this Order reference should be made to the Order itself, copies of which may be obtained from the Agricultural Wages Board, 80, Pall Mall, S.W. 1.

THE Wages Board are now proposing finally to abolish the method of payment of the various classes of stockmen in certain areas on the basis of an undefined number of hours

Wages of Stockmen. customary in the area. The system has been found to be open to many objections. Custom is too variable and uncertain a factor to be capable of precise definition, and as stockmen's hours vary in different districts, and even from farm to farm, employers and workers have been uncertain how the arrangements to which they were accustomed stood in relation to the general practice in the country.

If the new proposals are eventually confirmed as Orders, stockmen in all areas, except Norfolk and Suffolk, will be paid on the basis of a fixed number of hours per week, with overtime payments if these hours are exceeded. In Cambridgeshire, Huntingdonshire and Bedfordshire, Cumberland and Westmorland, and the Furness District of Lancashire, Denbigh and Flint, Gloucestershire, Merioneth and Montgomery and Warwickshire, the fixed number of hours for stockmen are longer than those for ordinary workers, but the proposed weekly minimum rates for stockmen in these cases are special inclusive rates calculated on the basis of the ordinary minimum rates, plus an extra sum to cover overtime payment for the additional hours. In the case of Norfolk and Suffolk a special arrangement has been made, which provides for the payment to workers of the special classes of the ordinary rates, with a separate lump sum to cover time spent in excess of the normal hours in connection with the feeding, cleaning, etc., of stock in lieu of payment at overtime rates. Overtime rates would, however, be payable for any time in excess of the normal hours spent on work other than work in connection with the care of animals.

Wages: THE Agricultural Wages Board have issued
Hours in Summer. a Notice of Proposal to reduce, as from the first Monday in October, 1919, the weekly number of hours on which the minimum wage is based in the summer period from 54 to 50.

THE following Memorandum (No. C.L. 185/L. 1) was addressed to Agricultural Executive Committees by the Board on 18th July, 1919 :—

**Labour for
Harvest Work.**

1. Applications for unskilled seasonal labour for harvest should be sent by employers direct to Employment Exchanges.
2. Where Committees think it necessary or desirable to establish depots or camps as hostels for accommodation they may make local arrangements as follows :—

(a) The local Agricultural Executive Committee will provide, if possible, the accommodation required. For lodgings, the Committee will make a suitable charge as may be necessary.

(b) Application may be made to the Military Authority at Command Headquarters for any equipment required.

(c) Coal and rations will not be obtainable from military sources. Any requirements in this respect must be covered by local arrangements, either by Committees direct or by those responsible under Committees or the management of depots, camps or hostels.

(d) Committees will be responsible for the receipt from and return to the Military Authorities of any equipment issued to them on requisition. In arranging charges for lodging, provision should be allowed in the amount charged sufficient to cover possible losses, and breakage, of equipment, and damage or dilapidations to premises allocated by the Quarters Committee.

(e) Facilities for the issue of cheap railway tickets have been arranged. Such tickets may be obtained from the Local Employment Exchange at approximately $1\frac{1}{2}$ of pre-war rates for the return journey, and particulars as to issue may be obtained from managers of Exchanges.

(f) The scheme as a whole should be made self-supporting, and so that no charge shall fall on public funds.

(g) The Orders of the Agricultural Wages Board will be applicable to all men engaged.

(h) Transport from the depot or hostel to the farm will be a matter of local arrangement.

(i) Committees will be responsible for the management and inspection of any depots, camps or hostels established under the scheme.

THE Agricultural Costings Committee* will shortly be issuing a series of pamphlets dealing with farmers' accounts and cost records.

Farm Accounts. Farmers and others who are already in communication with the Committee will receive these, and any other agriculturists desirous of having copies sent from time to time should notify the Director of Agricultural Costs, Palace Chambers, Westminster, S.W. 1. The pamphlets will deal with the advantages to be obtained from ordinary account keeping as distinct from cost-keeping, and descriptions of suitable and simple systems of book-keeping will be given. The more involved field of cost-keeping and its difficulties will also be dealt with. The various methods of ascertaining costs will be outlined, the books and records necessary for the purpose will be dealt with, and the problems and questions of principle involved in "Costing" will be discussed.

The Committee in the course of its inquiries is finding that a number of different types of cost records are being kept up and down the country. These differ considerably in their character from estimated records of the cost of, say, one crop of the farm, to complete systems of cost accounts covering the whole of the operations of the farm and showing the cost of each different branch.

The Committee would be glad to receive offers from farmers to send from time to time certain of the results of the future working of their farms, in order that the information may be collected and recorded for statistical purposes. The name of the farm or farmers would not appear in such records. A very large number of farmers who keep accounts have already communicated with the Committee, and others willing to do so should write to the Director.

THE Board of Agriculture and Fisheries have been officially informed that the importation of horses from the United Kingdom into the United States of America, except pure-bred horses for breeding and racing purposes, is prohibited.

* Notes on the work of this Committee were published in this *Journal*, June, 1919, p. 344, and July, 1919, p. 463.

THE Food Controller has issued an Order, entitled the Cereals (Restriction) Order, 1919, which incorporates, with certain amendments and additions, the provisions of three Orders

Restrictions on the use of Wheat, Barley, and Oats. which are thereupon revoked, viz. :—The Wheat, Rye and Rice (Restriction) Order, 1917* ; the Damaged Grain, Seeds and Pulse

(Prices) Order, 1917 ;† and the Grain (Prices) Order, 1918.‡ The new Order maintains the prohibition on the use of wheat for any purposes except the manufacture of flour or for use as seed, and the prohibition on the use of wheaten flour, rice or rice flour, or any article containing the same, except as human food or for the purposes of human food.

As regards wheat, exemption is only permitted in the case of "tailings or screenings or damaged wheat which are unfit for use in the manufacture of flour for human food," and have been so certified by any two members of a panel to be appointed by the Food Controller.

A maximum selling price for damaged wheat, both unported and home grown, and for tailings or screenings of wheat which are unfit for use in the manufacture of flour for human food is fixed at 72s. per qr. of 504 lb., additions being allowed to persons, other than the producer, similar to those permitted under the Grain (Prices) Order, 1918. Prohibition on the sale of wheat, barley, or oats otherwise than by weight is continued.

THE Food Controller made the following announcement in the House of Commons on 14th July :—

Food Control.

The Government have decided that the Ministry of Food shall continue for the present with full powers. I am accordingly making arrangements to regulate, during the coming winter, supplies, prices and distribution of essential foodstuffs, either by Statutory Order or by arrangement with the trades concerned.

The articles so controlled will comprise bread, meat, bacon, milk, cheese, butter, margarine, fish, eggs and certain subsidiary foods of which there may be an actual or prospective shortage.

It will not, I hope, be necessary to restrict consumption by a revival of the coupon system ; but it is already becoming difficult in some instances to adjust available supplies to a demand which has increased irrespective of price.

Addressing representatives of the Press on the following day at Palace Chambers, the Food Controller defined the food situation as follows :—

"So far as supplies are concerned, I look forward to the coming winter with a feeling, if not of assurance, at any rate of optimism. As regards prices, it is different. Although I am not as pessimistic as many people on this score, at the same time it will certainly require a great effort to prevent prices from rising beyond what they were last winter.

"As regards this question of prices, it is not the profiteer alone who is the cause of high prices to-day. If we only had to contend with the

* See this *Journal*, May, 1917, p. 236, and January, 1919, p. 1237.

† " " December, 1917, p. 1026, and June, 1918, p. 346.

‡ " " September, 1918, p. 742, December, 1918, p. 1128, and March, 1919, p. 1511.

profiteer the situation would be much simpler than it is. You can control the profiteer. You cannot control the world situation which has arisen as a result of the War. As I see that situation, it is this: the energies of the entire world have been devoted during the past 4½ years to one central task, that of destruction—destruction of life, of material, of treasure. Go where you will you will find this tale of destruction pursuing you. You will see its results in France and Flanders in the vast graveyards. You will see it in shipping—in the enormous destruction of tonnage. You will see it in finance—in the inflated state of the currency, the unfavourable foreign exchanges, and our enormous indebtedness. In the face of this situation there is only one thing which can possibly affect high prices, and that is increased production.

“It is more vitally necessary now for everyone to turn his energies to production than it was even during the War. Then we were producing in order to destroy. Now we must produce in order to live. Our only salvation lies that way. Unless we increase our production of every commodity, from coal to milk, we shall be doomed to higher and higher prices, and finally to social disaster.” (*The National Food Journal*, 13th August, 1919.)

As some misapprehension appears to exist with regard to the proposal of the Agricultural Wages Board to reduce the number of hours on which the minimum rates for male workers are based to 50 in summer and 48 in winter, it may be well to point out that no such reduction of hours is legally enforceable until a formal Order is made by the Wages Board.

The Board, at their next meeting on the 4th September, will consider all objections which have been lodged to this Proposal and will then decide whether or not an Order to give effect to the Proposal shall be made. In any case no such Order can come into operation earlier than the 6th October, 1919.

A DISPUTE arose in July between the employers of agricultural labour in Essex and their workers as regards the rates of wages to be paid during harvest. After some negotiation the two parties agreed to submit the dispute to an arbitrator to be appointed by the President of the Board of Agriculture and Fisheries. Sir Fielding Clarke was nominated, and after hearing arguments put forward on either side he made an award dated 28th July, 1919, to the following effect:—

**Harvest Wages :
Award to Agricultural
Labourers in Essex.**

The wages or remuneration which shall be paid or allowed to workers employed on the corn harvest of 1919 by an employer in the County of Essex who, on 14th July, 1919, had failed to agree with any aforesaid employee upon a rate or scale of wages or remuneration to be paid or allowed during the corn harvest to such employee as afore said shall be the ordinary pay of such workers, with differential rates for overtime employment as stated below.

(1) The differential rates of wages for overtime employment, whether on weekdays or Sundays, of male and female workers as above mentioned employed on the corn harvest in the County of Essex during such overtime as they are so employed, shall be as follows, in lieu of

the overtime rates otherwise applicable to such workers under Orders of the Agricultural Wages Board in force for the time being :—

<i>Age of Workers.</i>	<i>Overtime Rates per Hour.</i>			
	<i>Male</i>		<i>Female</i>	
	<i>Workers.</i>		<i>Workers.</i>	
	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>
18 years of age and over ..	1	8	1	0
17 and under 18 years of age ..	1	0	0	9
16 " 17 " ..	0	10	0	8
15 " 16 " ..	0	8	0	7
14 " 15 " ..	0	6	0	6
Under 14 years of age ..	0	5	0	5

2. For the purpose of this Award the expression " Overtime Employment " is defined to be—

- (a) All employment on a Sunday.
- (b) All employment in excess of 6½ hours on a Saturday.
- (c) All employment in excess of 9½ hours on any other day.

3. Provided that, for the purpose of determining whether any particular employment is overtime employment, regard shall be had to the total period of the worker's employment, whether such employment is on harvest work or otherwise.

THE existence of Foot-and-Mouth Disease was confirmed on the 2nd inst., at Kingsbury, Warwickshire. An Order was at once issued, prohibiting movement of animals over a wide area surrounding the infected place. Three further outbreaks have been confirmed, all in the immediate vicinity of the first case.

Foot-and-Mouth Disease.

All diseased animals, and all animals that are known to have been directly exposed to infection, have been slaughtered. No evidence as to the origin of the outbreak has been obtained.

Owing to the existence of Foot-and-Mouth Disease in this country the Canadian Government have cancelled all outstanding permits for the importation of cattle, sheep and other ruminants and swine into Canada from Great Britain.

AN outbreak of Rabies in Colchester having been confirmed by the Board on the 14th August, Orders were issued prescribing the muzzling of dogs in a district in North Essex and Suffolk having a radius of about 20 miles around Colchester and also requiring all dogs in any

Rabies.

public place in the borough of Colchester to be led as well as muzzled. The Order also imposes the usual restrictions prohibiting movement of dogs out of the Scheduled District except by licence of the Board and subject to quarantine. An outbreak of Rabies in Brecknock confirmed on 13th August necessitated an extension of the muzzling area in Monmouthshire and South Wales.

The total number of outbreaks of Rabies confirmed is now 235, namely, 101 in Devon, 27 in Cornwall, 70 in Glamorgan, 11 in Monmouth, 2 in Gloucester, 7 in Middlesex, 11 in Surrey, 1 in London, 2 in Kent, 1 in Berkshire, 1 in Brecknock and 1 in Essex.

THE Board of Agriculture and Fisheries make the following announcement :—

Grants in Aid of Agricultural Training for Officers. 1. As part of the Government Schemes of Higher Education and Training of ex-Service Officers, provision is made by the Board for financial assistance for agricultural training by means of :—

- (a) Grants for residential training with selected farmers in England or Wales ;
- (b) Agricultural scholarships at approved Universities or Agricultural Colleges in England or Wales.

2. Over 1,300 officers have now been approved for grants under (a), of whom over 1,000 are actually in training on farms, whilst 65 out of the 100 scholarships available under (b) have been awarded.

3. In view of the numerous applications which are still being received, the Board have decided that no application either for a *grant for training on a farm or for a scholarship can be entertained by them*—

- (1) *From any officer who has been demobilised by 31st July, 1919, unless the application has been lodged at the appropriate District Directorate of the Ministry of Labour on or before 31st August, 1919 ;*
- (2) *From any officer who has not been demobilised by 31st July, 1919, unless it is received by 31st December, 1919, except in any case in which it can be shown that for military reasons the application could not have been made by that date. All applications from non-demobilised officers should be made as soon as possible.*

4. Particulars of these farm training grants and agricultural scholarships, and of the manner of making application are given in the Board's Booklet—"Land Settlement in the Mother Country," (L.S. 9)*— which can be obtained either from the Board's offices at 72, Victoria Street, London, S.W. 1., or from any District Directorate of the Appointments Department, Ministry of Labour. The address of the appropriate District Directorate can be ascertained at any Post Office. Non-demobilised officers should make their applications on Army Form Z 15 or Navy Form S 1299.

5. Warrant officers, non-commissioned officers and men in the ranks of *suitable educational promise* are also eligible for these grants.

THE Board of Agriculture and Fisheries have awarded the Fream Memorial Prize for 1919 to Miss Doris Anderson, of Southfield, Ropley, Winchester, a student of University College, Reading, who took first place in this year's examination for the National Diploma in Agriculture.

The Fream Memorial Prize.

MISCELLANEOUS NOTES.

India.—According to an official forecast issued on 30th May, the total area under wheat in India in 1918-19 is 23,566,000 acres as against 35,357,000 acres the corresponding estimate for last year, or a decrease of 33 per cent., and the total yield 34,566,000 qr. as compared with 47,511,000 qr. at the same time last year, and 46,303,000 qr. the final revised figure for 1917-18. (*London Grain, Seed and Oil Reporter*, 21st July, 1919).

United States.—The Crop Reporting Board of the United States Department of Agriculture give the following estimates of production based on the condition of the crops on 1st August (in bush., and final official returns for 1918 in brackets):—Winter wheat, 715,000,000 (558,449,000); spring wheat, 225,000,000 (358,651,000); all wheat, 940,000,000 (917,100,000); maize, 2,788,000,000 (2,582,814,000); oats, 1,266,000,000 (1,538,359,000); barley, 204,000,000 (256,375,000); rye, 85,000,000 (89,103,000); and linseed, 10,000,000 (14,657,000).

The average yield per acre compared with that of 1918 (in brackets) is as follows (in bush.):—Winter wheat, 14·6 (15·2); spring wheat, 10·0 (16·0); all wheat, 13·1 (15·5); maize, 27·1 (24·0); oats, 29·9 (34·6); barley, 22·9 (26·5); rye, 12·9 (14·4); and linseed, 5·5 (7·6). (*London Grain, Seed and Oil Reporter*, 8th August, 1919).

Canada.—The report issued by the Canadian Government gives the condition of crops on 31st July, as follows (in bush. and condition on 31st May, 1919, in brackets):—Spring wheat, 77 (98); oats 81 (95); and linseed, 74. The total yield of wheat is estimated at 249,000,000 bush. (including 23,000,000 bush. fall wheat) as compared with 210,400,000 bush. harvested last year; oats at 406,000,000 bush. as against 476,690,000 bush.; and linseed at 8,000,000 bush. as against 6,100,000 bush. (*London Grain, Seed and Oil Reporter*, 16th August, 1919.)

THE quantity of rain that fell during July in various parts of the country has not been sufficient to effect any great change in the prospects of the harvest. The eastern part of the country has had rather more rain than the west, and while some small improvement may be recorded in the corn crops, the prospects of the root crops remain much the same as a month ago.

Agricultural Conditions in England and Wales on 1st August.

Wheat is the best of the three corn crops, but is by no means up to the average. Barley has perhaps improved more than any crop, while oats show as poor a promise as a month ago. The autumn-sown crops are much better than the spring, and of the latter the latest sown is, generally speaking, the worst. Harvesting of cut oats (chiefly winter oats) has begun in the south, but there is little mention of wheat cutting by 1st August, except in the extreme south-west. Straw, more particularly barley and oat, is short. Beans and peas are healthy crops, but the former have distinctly deteriorated during the month, while the latter have improved, so that they are now the more promising of the pulse.

Potatoes are still in need of rain, and the yield will probably be much below the average. The crop is, however, a very healthy one, and the reports generally are noteworthy for the absence of any serious mention of potato disease. The earlies have generally proved light but of good quality.

Some of the earliest sown fields of turnips and swedes are fairly satisfactory, as also some of the latest sown that were got in during wet weather; but, generally speaking, these roots have suffered badly from the drought, and show very poor prospects. Mangolds are in similar case, and their average condition is rather worse than a month ago.

Haymaking was mostly carried out under very satisfactory conditions, except in the later districts and where it was postponed until the rain came, and the very light crop is generally of good quality. In view of the deficiency of hay and probable shortage of roots, some farmers are putting in rape, mustard, or similar forage as a supplementary feeding crop, but this does not appear to be very general as yet, doubtless because in many parts of the country the ground is still too dry.

Hops show a very marked improvement, the only complaint against the weather being that it was hardly warm enough. The yards have remained unusually free from vermin, and a yield well over average is now expected, both in the Kent and the Worcestershire areas.

Prospects for orchard fruit have also improved, both apples and pears are above average, taking the country as a whole, though several of the western districts are disappointing. Plums are hardly average.

Pastures are still generally very bare, except in the east and south-east, where there has been some growth; live stock have as a consequence not done very well, and have not put on much flesh.

There are rather fewer reports of the deficiency of ordinary agricultural labour, partly owing to the fine weather and short hay crop, but skilled hands of all kinds are still very scarce.

Summarising the returns, and expressing an average crop by 100, the appearance of the crops on 1st August indicated probable yields per acre shown by the following percentages; Wheat, 92; barley, 86; oats, 80; beans, 90; peas, 91; potatoes, 91; mangolds, 77; seeds' hay, 80; meadow hay, 73; hops, 104.

THE following local summaries give details regarding agricultural labour in the different districts of England and Wales.

Agricultural Labour in England and Wales during July. *Northumberland, Durham, Cumberland, and Westmorland.*—Owing to the very favourable weather for hay-making less labour than usual has been required, and the supply has generally proved sufficient. In some districts, however,

there is a scarcity of casual labour for turnip-hoeing.

Lancashire and Cheshire.—On the whole the supply of labour is about sufficient, though in some districts more skilled men are required.

Yorkshire.—Skilled labour is still in very short supply and casual labour is scarce and inefficient. The closing down of factories through lack of coal is reported to have provided some relief among the latter class.

Shropshire and Stafford.—Labour is generally sufficient for requirements, though skilled men are still scarce and casual labour is not too plentiful for hoeing and haymaking.

Derby, Nottingham, Leicester, and Rutland.—In most districts the supply of labour is deficient, particularly skilled men, though in some parts it has been sufficient for requirements.

Lincoln and Norfolk.—The position as regards labour is improving, and in most districts there is sufficient. Horsemen are still scarce in some districts.

Suffolk, Cambridge and Huntingdon.—The supply of labour is sufficient in most districts, but good horsekeepers, stockmen, and shepherds are still wanted.

Bedford, Northampton and Warwick.—The supply of labour is very variable. In some districts there is sufficient for the requirements, but in others there is still a shortage.

Buckingham, Oxford, and Berkshire.—In most districts the supply of labour has been sufficient for requirements, but in some parts there is a deficiency of both skilled and unskilled men.

Worcester, Hereford, and Gloucester.—The supply of labour is generally sufficient to meet farmers' requirements, and where a shortage is indicated, it is usually of skilled men.

Cornwall, Devon, and Somerset.—The supply of labour is very variable; sufficient in some districts and short in others. There is still a demand for skilled hands.

Dorset, Wiltshire, and Hampshire.—The supply of labour has improved and is now generally sufficient for present needs, though skilled men are difficult to obtain.

Surrey, Kent, and Sussex.—Labour is somewhat deficient, particularly the skilled classes; and casual labour for fruit picking has also been scarce.

Essex, Hertford, and Middlesex.—In some districts the supply of skilled labour, and sometimes temporary labour, is short, but in others it has been equal to the demand.

North Wales.—The supply of labour is very variable in the division. In some districts it is sufficient for the work, in others deficient, particularly skilled hands.

Mid Wales.—The supply of labour seems sufficient to meet the requirements of the district; there is no marked shortage.

South Wales.—The supply of labour is not plentiful, but usually, owing to the good weather and light crops, no great shortage has been apparent, though in parts of Pembrokeshire a great scarcity is being felt.

AVERAGE PRICES of British Wheat, Barley, and Oats at certain Markets during the Month of July, 1917, 1918, and 1919.

—	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919.	1917.	1918.	1919.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	79 7	75 1	73 8	65 7	64 3	65 10	54 9	46 1	48 4
Norwich ...	77 11	74 8	73 7	67 2	56 6	...	55 0	45 1	48 5
Peterborough	78 8	74 6	73 2	65 1	56 5	60 10	54 11	...	...
Lincoln ...	78 1	74 10	73 5	65 7	56 8	63 11	56 0	...	...
Doncaster ...	77 11	74 0	72 10	65 4	56 5	...	55 0	45 1	48 4
Salisbury ...	78 5	73 11	72 8	74 4	56 1	62 6	54 11	45 9	...

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1917, 1918 and 1919.

Weeks ended (in 1919).	WHEAT.						BARLEY.						OATS.					
	1917.		1918.		1919.		1917.		1918.		1919.		1917.		1918.		1919.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan. 4...	76	0	71	2	72	2	66	4	58	0	62	3	47	1	45	5	48	8
" 11...	75	8	71	2	72	6	65	7	58	2	62	5	47	2	46	9	49	8
" 18...	75	8	71	3	72	7	64	9	58	1	62	3	47	4	47	9	50	0
" 25...	75	10	71	1	72	7	64	5	58	7	61	10	47	8	48	3	49	6
Feb. 1...	75	10	71	2	72	8	64	0	58	10	62	4	47	3	50	2	49	7
" 8...	76	0	72	0	72	7	63	5	59	0	62	3	46	11	50	6	49	2
" 15...	76	3	72	3	72	8	63	8	58	11	62	5	47	3	52	0	49	0
" 22...	76	9	72	2	72	8	63	9	58	9	62	6	47	8	52	3	49	4
Mar. 1...	77	4	72	2	72	7	64	0	57	9	62	7	48	0	52	0	48	8
" 8...	78	0	72	3	72	6	63	7	58	5	62	7	48	7	52	2	48	6
" 15...	78	10	72	4	72	5	64	1	56	10	62	5	49	4	51	0	46	8
" 22...	80	3	72	3	72	7	65	6	56	9	62	1	50	4	50	3	46	4
" 29...	81	5	72	4	72	7	71	10	56	7	62	8	51	10	48	10	46	11
Apl. 5...	84	4	72	11	72	6	69	11	56	7	62	8	55	1	49	10	47	2
" 12...	85	2	73	3	73	0	71	10	56	6	62	9	57	2	47	2	47	1
" 19...	84	10	73	3	73	1	70	6	56	6	62	9	59	8	47	0	47	3
" 26...	81	1	73	3	73	1	69	5	56	10	62	9	58	6	46	8	48	1
May 3...	77	7	73	5	73	2	64	4	56	5	62	8	54	9	47	4	48	7
" 10...	78	0	73	5	73	2	64	11	56	6	63	1	55	2	47	6	47	5
" 17...	77	11	73	4	73	3	64	10	56	6	62	4	55	2	46	4	47	11
" 24...	78	0	73	3	73	2	64	9	56	6	62	7	54	11	47	8	47	11
" 31...	78	0	73	8	73	3	65	11	60	0	62	7	54	11	44	9	48	3
June 7...	78	0	73	11	73	2	67	7	59	2	62	6	55	0	45	5	47	10
" 14...	78	2	74	3	73	3	75	6	57	9	62	8	55	1	45	7	48	11
" 21...	78	1	74	4	73	3	75	0	58	5	62	8	55	2	47	8	48	7
" 28...	78	3	74	4	73	3	73	11	57	10	63	4	55	1	46	4	49	1
July 5...	78	1	74	4	73	4	69	5	61	7	62	4	55	2	46	10	49	0
" 12...	78	2	74	4	73	3	70	10	57	5	63	1	55	1	47	0	49	11
" 19...	78	3	74	3	73	4	72	1	60	5	62	9	55	2	45	4	49	11
" 26...	78	3	74	3	73	4	65	7	56	11	63	4	55	2	46	2	48	11
Aug. 2...	78	2	74	3	73	3	73	6	57	1	62	10	55	0	45	10	50	3
" 9...	78	4	74	7	73	4	76	1	57	7	73	8	55	0	46	3	55	6
" 16...	78	7	74	2	73	3	68	11	61	4	75	2	55	6	55	11	61	4
" 23...	76	7	74	8			70	7	62	6			54	7	56	9		
" 30...	72	1	74	8			60	4	60	1			49	0	57	11		
Sept. 6...	71	6	72	3			59	3	60	4			46	7	56	9		
" 13...	70	7	72	5			57	2	60	1			45	0	49	2		
" 20...	70	8	72	6			56	10	60	4			45	8	49	11		
" 27...	70	6	72	7			58	5	60	3			44	7	50	3		
Oct. 4...	70	8	72	8			57	9	60	3			44	9	50	9		
" 11...	71	0	72	6			58	5	60	3			44	5	51	6		
" 18...	70	8	72	7			59	3	60	3			44	1	50	9		
" 25...	70	10	72	5			60	1	60	3			43	0	50	5		
Nov. 1...	70	4	72	4			59	11	60	3			42	4	50	8		
" 8...	70	3	72	4			60	2	60	3			42	11	49	11		
" 15...	70	3	72	5			60	2	60	3			43	0	49	10		
" 22...	70	2	72	4			59	9	60	10			43	1	51	1		
" 29...	70	2	72	3			59	3	62	2			44	6	50	4		
Dec. 6...	70	7	72	4			58	7	62	6			43	5	51	4		
" 13...	71	2	72	3			58	0	62	7			43	6	51	4		
" 20...	71	1	72	4			57	7	62	3			44	2	50	5		
" 27...	71	1	72	3			57	7	62	3			44	10	50	6		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in July and June, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	JULY.		JUNE.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
	per cwt. live weight	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.
FAT STOCK :—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Cattle :—				
Polled Scots	82 6	78 0	84 10	80 0
Herefords	82 3	76 11	85 2	80 0
Shorthorns	82 0	77 1	84 11	79 11
Devons	82 5	77 4	85 0	80 0
Welsh Runts	80 9	76 6	84 6	80 0
Fat Cows	77 1	69 0	79 11	71 10
	First Quality. per lb.*	Second Quality. per lb.*	First Quality. per lb.*	Second Quality. per lb.*
Veal Calves	<i>d.</i> 16½	<i>d.</i> 13½	<i>d.</i> 20	<i>d.</i> 17½
Sheep :—				
Downs	14½	14½	14½	14½
Longwools	14½	14½	14½	14½
Cheviots	14½	14½	14½	14½
Blackfaced	14½	14½	14½	14½
Welsh	14½	14½	14½	14½
Cross-breds	14½	14½	14½	14½
	per score. live weight.	per score. live weight.	per score. live weight.	per score. live weight.
Pigs :—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Bacon Pigs	21 0	21 0	21 0	21 0
Porkers	21 0	21 0	21 0	21 0
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>
Shorthorns—In Milk ...	50 13	37 7	50 11	37 4
—Calvers	47 10	36 10	46 11	35 9
Other Breeds—In Milk ...	44 11	33 19	40 2	30 11
—Calvers	31 0	29 10	—	—
Calves for Rearing	4 2	3 5	4 7	3 6
Store Cattle :—				
Shorthorns—Yearlings ...	16 5	13 10	17 7	14 3
—Two-year-olds...	27 5	22 6	27 17	22 14
—Three-year-olds...	35 10	31 9	37 7	32 15
Herefords—Two-year-olds...	27 0	21 10	28 0	27 12
Devons—	29 6	23 13	29 0	24 13
Welsh Runts—	25 0	—	27 15	19 5
Store Sheep :—				
Hoggs, Hoggets, Togs, and Lambs—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Downs or Longwools ...	59 1	50 4	83 3	70 5
Store Pigs :—				
8 to 12 weeks old	67 5	50 7	65 3	49 8
12 to 16 " " " " ...	102 9	81 5	102 0	82 0

* Estimated carcass weight.

NOTE.—The prices per lb. for sheep do not include the value of the skins or pelts, which during July made prices equivalent to an additional 1½d. per lb. of the carcass weight for Downs, Cheviots and Cross-breds, and 1½d. for Longwools, Blackfaced and Welsh, and during June, 1½d. per lb. for Downs, 1½d. for Blackfaced and Crossbreds, and 1½d. for Longwools, Cheviots and Welsh.

In addition to the price quoted above for sheep per lb., sellers were entitled, under the Live Stock (Sales) Order, 1918, to charge an extra amount ranging from 2s. to 6s. 8d. per head during July, and 4s. to 13s. 4d. during June according to the weight of the sheep.

**AVERAGE PRICES of PROVISIONS, POTATOES and HAY at
certain MARKETS in ENGLAND in July, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER :—	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.
British	—	—	—	—	27 6	—
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
„ Factory	—	—	—	—	—	—
Imported (Controlled)	252 0	—	252 0	—	252 0	—
CHEESE :—						
British—						
Cheddar	144 6	—	—	—	144 6	—
Cheshire	—	—	120 lb. 155 0 per cwt.	—	120 lb. 155 0 per cwt.	—
Canadian	144 6	—	144 6	—	144 6	—
BACON :—						
Irish (Green) ...	195 6	—	195 6	—	195 6	—
Canadian (Green sides)	198 6	197 0	199 0	195 0	199 0	195 0
HAMS :—						
York (Dried or Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green) (long cut)	192 0	190 0	192 0	190 0	194 0	191 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	41 10	39 2
Irish	39 2	—	36 5	34 11	37 5	35 5
Danish	—	—	—	—	42 0	39 10
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Early Eclipse ...	360 0	280 0	—	—	410 0	380 0
White Kidney ...	360 0	280 0	366 6	326 6	430 0	400 0
Other First Earlies	380 0	280 0	313 6	233 6	333 6	300 0
HAY :—						
Clover	—	—	—	—	—	—
Meadow	—	—	—	—	—	—

**AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in July, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	London.	Man- chester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
		s. d.	s. d.	s. d.	s. d.	s. d.
BEEF :—						
English	1st	119 0	119 0	—	119 0	119 0
	2nd	119 0	119 0	—	119 0	119 0
Cow and Bull	1st	119 0	119 0	119 0	119 0	119 0
	2nd	119 0	119 0	100 6	105 0	100 6
Irish : Port Killed	1st	—	—	119 0	119 0	—
	2nd	—	—	119 0	119 0	—
Argentine Frozen—						
Hind Quarters ...	1st	113 6	113 6	113 6	113 6	113 6
Fore „ ...	1st	74 0	74 0	74 0	74 0	74 0
American Frozen—						
Hind Quarters ...	1st	—	115 6	—	113 0	—
Fore „ ...	1st	—	76 0	—	73 6	—
Canadian Frozen—						
Hind Quarters ...	1st	—	115 6	—	113 0	—
Fore „ ...	1st	—	76 0	—	73 6	—
VEAL :—						
British	1st	106 6	145 6	—	127 0	105 6
	2nd	94 6	112 0	—	106 6	105 6
Foreign, Frozen ...	1st	—	—	—	112 0	—
MUTTON :—						
Scotch	1st	126 0	126 0	126 0	126 0	126 0
	2nd	126 0	126 0	126 0	126 0	126 0
English	1st	126 0	126 0	—	126 0	126 0
	2nd	126 0	126 0	—	126 0	126 0
Irish : Port Killed	1st	—	—	—	—	—
	2nd	—	—	—	—	—
Argentine Frozen	1st	101 0	101 0	101 0	101 0	101 0
New Zealand „	1st	—	—	—	101 0	101 0
Australian „	1st	—	—	—	101 6	98 0
LAMB :—						
British	1st	126 0	126 0	126 0	126 0	126 0
	2nd	126 0	126 0	126 0	126 0	126 0
New Zealand	1st	101 0	98 0	101 0	101 0	101 0
Australian ...	1st	—	—	—	98 0	98 0
Argentine ...	1st	101 0	101 0	101 0	101 0	101 6
PORK :—						
British	1st	—	149 6	149 6	149 6	149 6
	2nd	—	—	—	—	—
Frozen	1st	—	—	—	133 0	—

DISEASES OF ANIMALS ACTS 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	JULY.		SEVEN MONTHS ENDED JULY.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	15	12	115	155
Animals attacked	19	13	151	174
Foot-and-Mouth Disease :—				
Outbreaks	—	—	19	—
Animals attacked	—	—	154	—
Glanders (including Farcy) :—				
Outbreaks	1	4	15	23
Animals attacked	1	9	41	64
Parasitic Mange :—				
Outbreaks	310	239	3,787	3,229
Animals attacked	567	443	7,413	6,146
Rabies —				
Number of cases	10	—	125	—
„ „ Dogs affected	10	—	122	—
„ „ other animals affected	—	—	3	—
Sheep-scab :—				
Outbreaks	5	2	218	246
Swine Fever :—				
Outbreaks	282	157	1,296	876
Swine slaughtered as diseased or exposed to infection	119	86	564	346

IRELAND.*(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)*

DISEASE.	SIX WEEKS ENDED 26TH JULY.		7 MONTHS ENDED JULY.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	—	1	—	2
Animals attacked	—	1	—	2
Glanders (including Farcy) :—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Parasitic Mange :—				
Outbreaks	25	8	112	81
Sheep-scab :—				
Outbreaks	6	12	158	182
Swine Fever :—				
Outbreaks	2	5	20	14
Swine slaughtered as diseased or exposed to infection	3	19	63	48

The Weather in England during July.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
<i>Week ending 5th July :</i>								
England, N.E. ...	52.4	-5.9	1.15	29	+16	6	2.4	-4.1
England, E. ...	53.3	-6.6	0.77	20	+9	5	3.6	-3.4
Midland Counties ...	53.1	-6.4	0.06	24	+13	5	2.3	-4.2
England, S.E. ...	54.4	-6.1	0.71	18	+7	5	3.1	-4.3
England, N.W. ...	53.3	-5.0	0.76	19	+6	5	3.1	-3.6
England, S.W. ...	54.5	-4.6	0.51	13	0	3	7.6	+0.5
English Channel ...	56.0	-4.3	0.86	22	+10	3	6.2	-2.1
<i>Week ending 12th July :</i>								
England, N.E. ...	55.1	-3.7	0.18	5	-8	1	3.8	-2.4
England, E. ...	55.1	-5.4	0.59	15	+2	3	3.3	-3.5
Midland Counties ...	57.4	-2.3	0.35	9	-4	1	5.1	-0.9
England, S.E. ...	58.0	-3.4	0.34	9	-2	2	4.3	-2.9
England, N.W. ...	55.6	-3.0	0.11	3	-14	1	5.6	-0.8
England, S.W. ...	58.5	-1.0	0.17	4	-12	2	7.7	+1.1
English Channel ...	59.2	-1.8	0.37	9	-3	2	6.5	-1.5
<i>Week ending 19th July :</i>								
England, N.E. ...	57.6	-1.2	0.64	16	+1	3	6.8	+1.2
England, E. ...	58.3	-2.7	0.36	9	-6	3	6.0	-0.5
Midland Counties ...	59.2	-1.0	1.14	29	+17	3	5.1	-0.6
England, S.E. ...	58.7	-2.8	0.55	14	+1	3	5.3	-1.4
England, N.W. ...	57.6	-1.4	0.33	8	-9	3	5.5	0.0
England, S.W. ...	58.5	-1.6	0.74	19	+1	4	4.3	-1.8
English Channel ...	58.7	-2.7	0.30	7	-6	3	6.2	-1.1
<i>Week ending 26th July :</i>								
England, N.E. ...	55.8	-2.7	0.37	9	-9	4	3.6	-1.6
England, E. ...	56.2	-4.3	1.02	26	+11	5	3.0	-2.8
Midland Counties ...	56.9	-2.8	0.39	10	-9	3	3.9	-1.3
England, S.E. ...	57.8	-3.6	0.56	14	-1	5	3.4	-3.0
England, N.W. ...	57.4	-1.4	0.22	6	-16	1	6.9	+1.7
England, S.W. ...	58.0	-1.9	0.28	7	-14	2	8.1	+2.4
English Channel ...	59.9	-1.4	0.7	2	-13	2	8.5	+1.5

* 1 inch = 25.4 millimetres.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Willis, J. C.—A Dictionary of Flowering Plants and Ferns (4th Edition) (712 pp.) Cambridge: University Press, 1919. 20s. net. [58.2.]

Institute of Makers of Explosives.—The Use of Explosives in Making, Ditches. (70 pp.) New York: Institute of Makers of Explosives, 1917. [63.14(04); 63.196.]

Fruwirth, C.—Die Saatenanerkennung. (131 pp.) Berlin: Paul Parey 1918. [63.1951.]

Wrightson, J., and Newsham, J. C.—Agriculture: Theoretical and Practical. [2nd edition.] (648 pp.) London: Crosby Lockwood, 1919, 10s. 6d net. [63(022).]

- Board of Education*.—Training in Farm and Garden Work in Reformatory and Industrial Schools. (16 pp.) London: H.M. Stationery Office, 1919. 2d. net. [372; 63.5(07).]
- North of Scotland College of Agriculture*.—Bull. 23:—The Size of Seed. (16 pp.) Aberdeen, 1919. [63.1951.]
- Green, F. E.*—First Advice to Would-be Farmers. (190 pp.) London: "Country Life" Offices, 1919. 5s. net. [63(022); 63.191.]
- Burrough, M. W.*—Income Tax for Farmers together with a Simple Form of Book-keeping specially Adapted for Farmers. (36 pp.) London: Iliffe & Sons, 1918. 1s. 6d. net. [657.]
- McConnell, P.*—Note-Book of Agricultural Facts and Figures for Farmers and Farm Students. (538 pp.) [9th Edition.] London: Crosby Lockwood & Sons, 1919. 15s. net. [63(03).]
- Peters, C. A.*—The Preparation of Substances Important in Agriculture: A Laboratory Manual of Synthetic Agricultural Chemistry. (81 pp.) New York: Wiley & Sons [London: Chapman & Hall], 1919. 4s. net. [54(02).]
- F. W. Oliver* [edit.].—Life and its Maintenance: A Symposium on Biological Problems of the Day. (297 pp.) London: Blackie & Sons, 1919. 5s. [575.]
- Bower, F. O.*—Botany of the Living Plant. (580 pp.) London: Macmillan & Co., 1919. 25s. net. [58(02).]
- Wild, L. J.*—Soils and Manures in New Zealand. (134 pp.) Auckland and London: Whitcomb and Tombs, 1919. 2s. 6d. [63.11(02); 63.16(02).]
- Agricultural Education Association*.—Memorandum on the Reconstruction of Agricultural Education in England and Wales. (64 pp.) The Association, Harper Adams College, Newport, Salop. 1s. [37(04); 37(42).]
- Rome, International Institute of Agriculture*.—The International Movement in Fertilisers and Chemical Products useful to Agriculture. (6th Review—1918.) [Documentary Leaflets, 3rd Year, No. 5.] [63.1621.]

Field Crops—

- Gilbert, A. W.*—The Potato. (318 pp.) New York and London: The Macmillan Company, 1917. \$1.50. [63.512(02).]
- North of Scotland College of Agriculture*.—Bull. 24:—Red Clover. (39 pp.) Aberdeen, 1919. [63.33(b).]
- Millar, A.*—Wheat and Its Products. (134 pp.) London: Pitman & Sons, 1916. 2s. 6d. net. [63.311(02).]
- Bews, J. W.*—The Grasses and Grasslands of South Africa. (161 pp.) Pietermaritzburg. P. Davis & Son. [London: Wesley & Sons, 1918.] 9s. [58.19; 63(08).]
- Wright, F. B.*—Distillation of Alcohol from Farm Products. (271 pp.) New York and London: E. & F. N. Spon, 1918. [663.5.]

Horticulture—

- Fletcher, S. W.*—The Strawberry in North America: History, Origin, Botany and Breeding. (234 pp.) London and New York: The Macmillan Company, 1917. \$1.50. [63.41(c).]
- Chisholm, J. S.*—Vegetable Gardening. (124 pp.) London: T. C. & E. C. Jack, 1919. 1s. 3d. net. [63.51(02).]

Live Stock—

- Wood, T. B. and Halnan, E. T.*—Composition and Nutritive Value of Feeding Stuffs [New Edition.] (24 pp.) Cambridge: University Press, [1919.] 1s. net. [63.604.]
- Miller, E. D.*—Horse Management in the Field at Home and Abroad. (124 pp.) London: Gale & Polden, 1919. 1s. 6d. net. [63.61(02).]
- Holdsworth, G. L.*—Twelve Lectures on the Care of Horses. (48 pp.) London: Gale & Polden, 1919. 2s. net. [63.61(02); 619.1.]
- Spencer, Sanders*.—The Pig: Breeding, Rearing and Marketing. (184 pp.) London: C. A. Pearson, 1919. 3s. 6d. net. [63.64(02).]

THE JOURNAL OF THE BOARD OF AGRICULTURE

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EDITORIAL NOTES.

THE analysis by Mr. Hoover of the economic situation in Europe (p. 580) suggests a state of affairs as regards food supplies

Food Supply and Increased Production.

which is inadequately realised by the British public if only because the facts have not hitherto been sufficiently fully placed before them in a comprehensive statement.

According to Mr. Hoover's views the situation is :—

- (1) That Europe, including the British Isles, is not producing sufficient food for its 450,000,000 population (with Russia) ;
- (2) That it is already clear that Europe cannot rely on the Western Hemisphere for sufficient surplus produce to meet the present deficiency in European production ; and
- (3) That, with the temporary aid of the Western Hemisphere in tiding over the shortage, the only means of avoiding shortage of supplies for European populations lies in a rapid increase in the production of necessities (as compared with mere luxuries), combined with the stringent practice of economy and the arrest of the disheartening outbreak of extravagance to which Mr. Hoover refers.

The moral of the position surely is that while British farmers bore a heavy burden during the War in raising the actual agricultural output, the necessity is still laid upon them of ensuring that there shall be no falling off now, but a continued effort to obtain even greater results.

* * * * *

THE rise in agricultural wages that has been recently taking place has directed an unusual amount of attention to the quantity and quality of the available

The Worker's Share in Agriculture.

labour—and of its influence on food production or the fertility of farm land. If we regard the farm and all its stock and appliances as in the nature of a factory it will at once be conceded that the worker on the farm and the

worker in the factory have one thing in common—both are essential to the working of the plant and the production of the articles in view. The factory hand, however, is liable to be highly mechanical and to have little influence on the actual business, whereas the agricultural worker commonly has a very real influence on the general farm management. The actions of the farm worker are largely governed by varying conditions of soil, climate, etc., calling for considerable knowledge and judgment, and often for most unselfish devotion to his work—as in caring for live stock or in harvesting crops with speed. His relations with his employer are usually exceedingly friendly, and it is highly desirable that cordial mutual interest should grow rather than decrease. The difficulties which have to be faced in this connection, and the means which may be adopted to encourage such co-operative and genial relationship between employer and employed, were discussed by Sir Henry Rew in an address delivered to the Agricultural Club, reproduced at page 584.

* * * * *

THERE is a general opinion, for which there would appear to be sound reasons, that the future of the live stock industry, and of the breeding of high-class stock in particular, is distinctly encouraging. For some time to come the breeder of good stock is likely to have little difficulty in disposing of his surplus animals at very remunerative prices, and this should give a great impetus to the improvement of live stock among all classes of farmers.

Improvement of Live Stock.

The small farmer, however, if left to his own resources finds difficulty in employing pure-bred sires, the initial outlay as regards purchase making too heavy a call on his capital. Moreover, risk of illness and possible loss of such stock is too great. Payment for service is therefore substituted for ownership, and the best sires are not always used. It was to assist this type of farmer that the Board's Live Stock Improvement Scheme was introduced in 1914. The scheme seeks to improve the inferior stock of the country by educating farmers to use pedigree sires, and to keep milk records. Financial assistance is provided to bring these methods within the reach of smaller farmers.

The report on the scheme for 1918-19 which appears in this issue (p. 591) shows that in spite of the severe handicap imposed by the War the progress made over the five years during which the scheme has been in operation has been steady and continuous. The measure of success is not to be gauged merely by the number of pedigree sires located under the scheme, since all the

farmers in the surrounding district received a practical demonstration of the advantages of good breeding.

The scheme has successfully passed through an exceptionally trying experimental period, and it is anticipated that during the next few years it will play a still more important part in the improvement of British live stock.

* * * * *

SERIOUS endeavours are being made to ensure a large decrease in the rat population of the country during the coming autumn and winter. Local authorities have been

**A
National
Rat Week.**

urged to prepare for an effective campaign, and to this end a series of two or three national "rat weeks" is being organised throughout the land (p. 628). In order that success shall attend the work the local schemes should be co-ordinated county by county, and no district, town or farm should be overlooked. A rat week on one farm will drive rats to the next unless it too has its rat week at the same time. Every care needs to be exercised that rats shall not escape in this way, and also that live stock shall be adequately protected wherever poisons are employed. In one case recently a gardener lost a number of well grown and valuable chickens in one night through the depredations of rats, and thereupon used a rat poison harmless to poultry—since when he "has not seen so many rats." In another case a different poison was laid to destroy rats, and unfortunately the rats must have dragged the bait through fowl runs, ten valuable birds, chiefly pullets, having been poisoned—the last two at any rate from certified phosphorus poisoning. Every effort should be made and all reasonable expenditure incurred to destroy rats.

* * * * *

THE tractor trials which are to be held at Lincoln commencing on the 24th September have brought together a large and

**Lincoln Tractor
Trials.**

representative collection of types. The total number of tractors entered is 59, representing 32 types nearly equally divided between American and British machines. One Italian tractor, the F.I.A.T., will compete. Many of the types will be new to the British public, and the trials as a whole may be said to exhibit the most recent developments in agricultural tractor design which have been brought beyond the experimental stage.

In conjunction with the trials an exhibition of agricultural machinery and implements is to be held at the South Carlton Aerodrome.

THE ECONOMIC SITUATION IN EUROPE.

STATEMENT AND ANALYSIS BY MR. HERBERT C. HOOVER,

Director-General of Relief, Supreme Economic Council.

THE following passages on the economic situation in Europe are extracts taken from a Memorandum prepared by Mr. Hoover for special purposes and not for publication. The Food Controller, however, considered it of such interest that he asked to be allowed to publish it in the *National Food Journal*, the official organ of his Department. Mr. Hoover consented on condition that it was viewed as an analysis and not as a criticism. It is felt that the passages here reprinted from the statement published in the *National Food Journal* for 13th August, 1919, will be of special interest to agriculturists.

The economic difficulties of Europe as a whole at the signature of Peace may be almost summarised in the phrase "demoralised productivity." The production of necessities for this 450,000,000 population (including Russia) has never been at so low an ebb as at this day.

It is not necessary to review at length the causes of this decrease of productivity. They are, in the main, as follows :—

The industrial and commercial demoralisation arising originally out of the War, but continued out of the struggle for political rearrangements during the Armistice, the creation of new Governments, their inexperience, and friction between these Governments in the readjustment of economic relations.

The proper and insistent demand of labour for higher standards of living and a voice in administration of their effort has unfortunately become impregnated with the theory that the limitation of effort below physical necessity will increase the total employment or improve their condition.

There is a great relaxation of effort as the reflex of physical exhaustion of large sections of the population from privation and from the mental and physical strain of the War.

To a minor degree, considering the whole volume, there has been a destruction of equipment and tools, and loss of organisation and skill, due to war diversions, with a loss of man-power. This latter is not at present pertinent in the face of present unemployment.

(The demoralisation in production of coal. Europe to-day is an example in point of all these three forces mentioned above, and promises a coal famine with industrial disaster unless remedied. It is due in a small percentage—from the

destruction of man-power—to the physical limitation of coal mines or their equipment. It is due in the largest degree to the human factor of the limitation of effort.)

The continuation of the Blockade after the Armistice has undoubtedly destroyed enterprise even in open countries, and, of course, prevented any recovery in enemy countries. The shortage in overseas transportation, and the result of uncertainties of the Armistice upon international credits, have checked the flow of raw materials and prevented recovery in the production of commodities especially needed for exchange for imports from overseas. The result of this delay has been unemployment, stagnation, absorption of capital in consumable commodities to some extent all over Europe.

From all these causes, accumulated to different intensity in different localities, there is the essential fact that, *unless productivity can be rapidly increased, there can be nothing but political, moral and economic chaos, finally interpreting itself in loss of life on a scale hitherto undreamed of.*

Coincident with this demoralisation in production, other disastrous economic phenomena have developed themselves, the principal one of which is that the very large wages paid to special workers, and the large sums accumulated by speculation and manufacture during the War, have raised the standard of living in many individuals from the level of mere necessities to a high level of luxuries. Beyond this class there is a reflex in many other classes from the strenuous economies against waste and the consumption of non-essentials in all countries; and, as a result, there is to-day an outbreak of extravagance to a disheartening degree.

Another economic change, of favourable nature from a human point of view, but intensifying the problems of the moment, has been the rise in the standard of living in large sections of the working classes through the larger and better wage distribution, separation allowances, etc., during the War. Parallel with these classes are those of fixed income, the unorganised workers, and the unemployed, on whom the rising cost of living is inflicting the greatest hardship.

During some short period it may be possible for the Western hemisphere, which has retained and even increased its productivity, to supply the deficiencies of Europe. Such deficiencies would have to be supplied in large degree upon credits. But aside from this, *the entire surplus productivity of the Western hemisphere is totally incapable of meeting the present deficiency in European production if it is long continued.*

Nor, as a practical fact, could credits be mobilised for this purpose for more than a short period, because all credits must necessarily be simply an advance against the return of commodities, and in exchange, and credits will break down the instant that the return of commodities becomes improbable. Further, if such credits be obtained for more than temporary purposes, it would result in economic slavery of Europe to the Western hemisphere, and the ultimate end would be war again.

The solution, therefore, of the problem, except in purely temporary aspects, does not lie in a stream of commodities on credit from the Western hemisphere, but lies in a vigorous realisation of the actual situation in each country of Europe and a resolute statesmanship based on such a realisation. The populations of Europe must be brought to a realisation that productivity must be instantly increased.

The stimulation of production lies in the path of avoidance of all limitations of the reward to the actual producer. In other words, attempts to control prices (otherwise than in the sense of control of vicious speculation) are the negation of stimulation to production, and can only result in further curtailment of the total of commodities available for the total number of human beings to be fed, clothed, and housed.

There still exist in Europe great bureaucracies created from the necessity of control of price and distribution by the conditions of the War, who are loath to recognise that with world markets open no such acute situation exists, and that their continued existence is not essential except in the control of speculation. The argument so much advanced that world shortage may develop, and justifies continued control of distribution and price, is based upon the fallacious assumption that, even if the world markets are freed of restraint, there is a shortage to-day in any commodity so profound as to endanger health and life.

From any present evidence, thanks to the high production outside Europe, no shortage exists that will not find its quick remedy in diminished consumption or substitution of other commodities, through minor alteration and price. All attempts at international control of price, with a view to benefit the population in Europe at the cost of the producer elsewhere, will inevitably produce retrogression in production abroad, the impact of which will be felt in Europe more than elsewhere. A decrease of 20 per cent. of Western hemisphere wheat would not starve the West ; it would starve Europe.

It must never be overlooked that control of price and distribution cannot stop with a few prime commodities, but, once started, its repercussions drive into a succeeding chain of commodities; and that on the downward road of price control there can be no stoppage until all commodities have been placed under restriction, with inevitable stifling of the total production.

It is also often overlooked by the advocates of price control that, whereas the high level of production was maintained during the War even under a restraint of price, this high production was obtained by the most vivid appeal to patriotic impulse on both sides of the front. This stimulus to production and distribution no longer obtains, and the world must go back to the prime impulse—and that is the regard to the individual producer and distributor.

That body of advocates who have deduced from war phenomena that production and distribution can be increased and maintained by appealing to altruism as the equivalent of patriotism or self-interest should observe the phenomena of Russia, where the greatest food-exporting country is to-day starving.

It must be evident that the production cannot increase if political incompetence continues in blockade, embargoes, censorship, mobilisation, large armies, navies and war.

There are certain foundations of industry in Europe that, no matter what the national or personal ownership of control may be, yet partake of the nature of public utilities in which other nations have a moral right. For instance, the discriminatory control of ships, railways, waterways, coal and iron in such a manner as to prevent the resumption of production by other States will inevitably debar economic recuperation and lead to local spats of economic chaos with its ultimate infection abroad, to say nothing of the decrease in productivity. These misuses are already too evident.

The question of assistance from the Western hemisphere during a certain temporary period, and the devotion of its limited surplus productivity to Europe, is a matter of importance and one that requires statesmanlike handling and vision. It is but a minor question compared to those stated above, and it is in a great degree dependent upon the proper solution of the factors already touched upon.

It is a service that the Western hemisphere must approach with a high sense of human duty and sympathy. This sense will, however, be best performed by the insistence that its aid would not be forthcoming to any country that did not resolutely

set in order its internal financial and political situations, that did not devote itself to the increase of productivity, that did not curtail consumption of luxuries and the expenditure upon armaments and did not cease hostilities, and did not treat its neighbours fairly.

If these conditions were complied with, it is the duty of the West to put forth every possible effort to tide Europe over this period of temporary economic difficulties. Without the fulfilment of these conditions the effort is hopeless.

With Europe turned towards peace, with her skill and labour aligned to overcome the terrible accumulation of difficulty, the economic burden upon the West should not last over a year, and can be carried, and will be repaid. To effect these results the resources of the Western hemisphere and of Europe must be mobilised.

THE WORKER'S SHARE IN AGRICULTURE.*

Sir HENRY REW, K.C.B.

Influence of the War.—We are in the throes, painful and perhaps prolonged, of the birth of a new world. Political, social and economic frontiers and landmarks have been shifted, and we have to redraw the map of the common life of mankind, as the Allies have redrawn the map of Europe. In the welter of change only one factor of civilisation remains stable—human nature. The great War has been the greater leveller. The doctrine of the equality of man, since it was propounded by Christ, has been preached—and also perverted—through all the Christian era, but the comradeship of War has hammered into millions of minds the truth that, however much men may differ superficially, or however different may be their places in the ordered life of the community, they are much alike in all the fundamental virtues and vices which go to make up what we term character.

It is from this angle, and in the lurid light of war experience, that the relations of men, and of classes of men, must hereafter be viewed.

One notable result of the War is that, in the national effort to increase food production, the importance of the manual worker has been recognised. The ultimate dependence of

* An address delivered to the Agricultural Club on 3rd July, 1919.

agriculture upon labour has been demonstrated and the worker's share in production has been realised. Farmers at the present time do not stand very well in popular esteem, and the public are inclined to forget the real service which they rendered to the country in its hour of need. There is no doubt that the vast majority of them worked whole-heartedly and unreservedly to increase food production from a sense of patriotism and duty. But if it is true that the services of farmers are apt to be overlooked, it is equally true that recognition has never been adequately accorded to the labourers, without whose help all effort would have been in vain. The invaluable assistance rendered by women and others who had not previously been accustomed to agricultural service has been appreciated by the public, but the steady hard work of the native sons of the soil, which was the basis of all, is apt to be forgotten. The share of the worker in agriculture during the War is undeniable, and he became conscious, perhaps for the first time, that he is, equally with the farmer, a producer of the nation's food.

The Worker's Position in Agriculture.—Of course, the very real influence which the agricultural labourer often has in the cultivation of the land and the management of stock is well known, and is by many farmers freely acknowledged. His advice is often sought, and frequently taken, for it is based on close observation and intimate knowledge of the land on which probably he and his forebears have been rooted for centuries.

Kipling's lines on the hereditary worker on the land express a fundamental fact on English country life :—

" His dead are in the churchyard—thirty generations laid,
Their names went down in Domesday Book when Domesday
Book was made,
And the passion and the piety and prowess of his line,
Have seeded, rooted, fruited in some land the Law calls mine.
Not for any beast that burrows, not for any bird that flies,
Would I lose his large sound counsel, miss his keen amending
eyes."

The worker's share in agriculture, therefore, consists not only of the supply of labour and skill in the actual performance of farming operations, but oftentimes includes the contribution of knowledge and experience to the management of the farm. In such cases there is a real co-operation between employer and worker to wrest from nature the utmost of which the land is capable.

It may be said that such co-operation, such mutuality of interest, is rare, or at any rate is becoming less common. Whether this is so or not, it will be generally admitted that this kind of relationship between master and man is desirable, and that all possible means should be adopted to encourage it. If the worker has a real share in agricultural production, he is obviously entitled to a fair share in the results. So far everyone agrees, but the trouble comes in the attempt to define that share, and to determine the method of ascertaining it. In the past, the conception of labour as a mere commodity for purchase and sale has been too crudely expressed. Of course, services have an exchange value as well as goods, and in the long run the value of them is fixed by supply and demand. Just as it is not possible to sell more hats or boots than there are persons wishing to wear them, just as the number and remuneration of farmers, as of doctors or lawyers or shopkeepers, are decided by the extent of the demand for the services they can supply to the community, so also the number and remuneration of workers in agriculture must be determined eventually by the amount of work on which they can be profitably employed. In these days it is unfashionable to call attention to anything so antiquated as the law of supply and demand; but it is not the law, but its application, which has been at fault in regard to labour. When it is used to justify the final settlement of the value of man's services by the "higgling of the market," and by no other consideration, it is recognised as inhuman in its application.

Difficulties of the Future. The Relationship between Capital and Labour.—The trouble, of course, is that, when you give up the old method of paying as little, whether for goods or services, as you can by any means induce the owner of those goods or services to accept, you are left to find some other principle. This is not easy. Some of our modern teachers find no difficulty in laying down a principle for fixing wages. They say that wages must be such an amount as is necessary to maintain the wage earner in a reasonable standard of comfort. We should probably all agree to this as an abstract proposition, but it is not a simple matter to express an abstract proposition in pounds, shillings and pence. I confess that I find difficulty in conceiving of wages, or even of salaries, in the abstract. They seem to me necessarily to have a very concrete relation to the resources from whence they are paid. There are, no doubt, exceptions, but, in general terms, it must be true that

the labour bill in any industry will have some fairly definite relation to the total proceeds of the industry.

In this elementary consideration of first principles, it may be worth while to recall one or two obvious facts. In the case of farming, the need for both capital and labour is self evident, for an ordinary farm crop a man must find money for seed, manure, implements, horses and their keep, and also for his own subsistence, for 12 months before he can realise the crop. If he employs more labour than his own he must also advance the whole of the payment for that labour, before he gets any return for it. That is the true function of capital, which, of course, is only another name for accumulated savings. The wage-earner has also to advance his capital—which is his labour—usually for not longer than a week, though sometimes for longer periods—before he gets paid for it. Now, of course, no man will use his savings, *i.e.*, his capital, in trying to grow a crop unless there is a reasonable prospect, first that it will not be diminished, and secondly, that he will get some return for its use. The general theory that capital will not be invested in an industry unless it will bring a return equal to that which could be obtained, with the same degree of risk, in some other use, is not strictly true of agriculture. Capital is, and always has been, attracted to agriculture at a relatively low rate of interest, but there is a point at which no one will be prepared to risk his money.

A similar principle applies to the wage-earner. He will only consent to work on the production of the crop if he is assured of not less remuneration for his services than he can obtain in some other employment, subject again to the fact that some men are willing to work on the land and in the country for lower wages than they will accept in other occupations.

These truisms lead up to the self-evident proposition that both capital and labour must each take a share of the proceeds of the crop, if the crop is to be grown at all. The problem is, on what basis are those shares to be calculated?

Facts to be considered in rating Wages.—Among the questions which will receive the consideration of the Royal Commission on Agriculture will no doubt be the monetary share of the workers in the produce of the industry. At present the material for any calculation is scanty. From the data given in the report of the Wages Board Committee on the financial results of farming,* it appears that on 26 farms

* Cmd. 76, 1919. Price 9d., post free, 1s. Published by H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2.

the labour bill during the five years 1913-14 to 1917-18 represented from 17 to 19 per cent. of the total expenditure, and from 15 to 18 per cent. of the total receipts. On 21 "home" farms the labour bill represented from 22 to 24 per cent. of the total expenditure. Such figures, however, help us very little to form an opinion as to the basis on which the worker's share should be assessed.

The facts which have to be taken into consideration are not merely statistical. They are mainly human and personal. From the employer's point of view, the first consideration is that the work should be done efficiently and punctually, that it should be done with a sense of responsibility—and with willingness to meet any disturbance of daily routine which weather conditions, or the nature of the work, necessitate. The employer does not want a human machine, he wants an intelligent man who is interested in his work and its results.

Now it is generally true, human nature being what it is, that men will not continually put forth their best efforts, physically and mentally, without a definite incentive. The incentive is not always financial. It often is simple pride in their work, and a feeling of self-respect which will not allow them to do less than their best. Various motives animate different individuals, but it still remains true as a broad generalisation that, year in and year out, a man will do better work if by so doing he earns more money than he will if his remuneration has no relation to the amount or character of his work.

If this is true, it leads to the conclusion that the farm worker will produce more if he has a share in the increased production which results from his extra efforts. In other words, a definite interest in the financial results of the farm will provide an incentive to work and a stake in the success of the undertaking, which will form a binding link of mutual interest between employer and worker.

There is a story of a factory owner who stated that if his workmen liked, they could save him £10,000 a year by less waste and better work, and was somewhat pertinently asked why he did not offer them £5,000 a year to do it.

Profit-Sharing and Co-Partnership.—There are two methods of attaining this object, which have been more or less tested by experience—one known as profit-sharing, and the other as co-partnership.

Profit-sharing.—Profit-sharing is an agreement by the employer to pay to the worker a share, fixed in advance, of the profits of the undertaking.

Co-partnership.—A definition of co-partnership, drawn up in October, 1911, stated that "In its simplest form, taking the case of a man employed by a great limited liability company, it involves :—

1. That the worker should receive, in addition to the standard wages of the trade, some share in the final profit of the business, or the economy of production.
2. That the worker should accumulate his share of profit, or part thereof, in the capital of the business employing him, thus gaining the ordinary rights and responsibilities of a shareholder."

Anyone who wants to know what has been done in the direction of adopting these two principles in industry generally should refer to the Report on Profit-sharing and Labour Co-partnership in the United Kingdom, issued by the Board of Trade in 1912.* According to this Report there were on 1st August, 1912, six schemes of profit-sharing in agriculture, affecting 737 workers. Among the employers responsible for these schemes were Lord Rayleigh, Messrs. Strutt and Parker, and Lady Wantage. This does not take account of agricultural co-operative societies, of which there were at that date 335, mostly in Ireland. Some particulars of a co-partnership farm are given in the Report of the Wages Board Committee already mentioned.

It must be admitted that, up to the date of the Board of Trade Report, the history of profit-sharing schemes in agriculture had not been very encouraging, for it was recorded that out of 18 schemes which had been started, 12 had been abandoned. But as the man who never makes a mistake never makes anything, so failure to succeed is no evidence that success is unattainable. The fact that six schemes had succeeded, or at any rate, survived—and I believe there are now others—shows that the problem is not insoluble.

Value of a closer Relationship between Employer and Employed.—I admit that if we accept the view that there are not now, and never again will be, any profits in farming, a discussion of methods of sharing them is waste of time. But I submit that, if only for the sake of argument, we must assume that farming in this country will be carried on, and as no industry can long be carried on without profits, the discussion is not quite futile. If there is any truth in the remarks which I made at the outset, we shall not get much help in the

* Cd. 6496, 1912. Price 8½d., post free 11d. Published by H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2.

times in which we now live by quoting precedents from the Victorian era. The point to be established is that it is desirable that the workers should have a definite share in the financial results of their labour, and that the inducement to them to use their best efforts should not be merely the fear of losing their job. If this principle is right in itself, and if its adoption in agriculture will strengthen the bonds which should unite those engaged in the same calling, emphasise their common interest, and increase the production of the land, I cannot believe that the wit of man is incapable of devising a practical means of applying it.

At the beginning of these remarks I referred to the fact that it is not infrequent for a farmer to take counsel with the more experienced of his labourers, in regard to the operations of the farm, and thus to invite him in a limited degree to take a share in the management. A tendency is also becoming prominent among the workers in other industries to claim a definite share in the control of the business in which they are employed. This is quite distinct from a claim to a share in the management, which may be given under a profit-sharing or co-partnership scheme, in respect of capital invested in the undertaking. The claim is made by wage-earners as wage-earners.

It has been expressed by a prominent Labour leader in these words: "We invest our lives in these mines, which is of greater importance than the capital of the employer, and to that extent have a right to say as to what the conditions shall be, not merely the working conditions, but we are entitled to have some information on the commercial side of the thing also." Of course, it may be said that farming is not mining, and that the conditions of employment and the organisation of the industry are totally dissimilar. No doubt this is true, but the following quotation from a letter in *The Times*, written by Lord Robert Cecil in February last, suggests that the same idea which miners entertain is not entirely unknown in agriculture. Lord Robert wrote:—"At the late election in one of the villages in my constituency there was apparent a strong anti-employer feeling, and I was told that it was due to the fact that the local farmer—an incompetent man—declined to listen to the advice of the men employed by him, who had far greater experience in agriculture than he had. They argued that he was not only ruining himself, which was his affair, but in so doing he was ruining, or likely to ruin, them also, and that it was intolerable that they should not even be consulted before,

such follies were perpetrated." There may, of course, be another side to such a story. The conservative instinct—I am not talking of politics—is deeply rooted in everyone connected with the land, and in none more so than the agricultural labourer. I have no doubt that any progressive farmer who wished to introduce new practices, or to make experiments, would often do so in face of general criticism, if not hostility, from his men. I think also, that a farm, like a ship, can only be run by one captain, and that any attempt to farm by a committee would be the shortest road to ruin. The sort of feeling to which Lord Robert Cecil referred could only be aroused by a degree of tactlessness on the part of an employer in dealing with his men which we may hope is extremely rare. But the desire of workers in any capacity to be taken into confidence with regard to the business in which their lives are bound up, and on which their livelihood depends, is a natural one, and it seems to me that it is wisdom on the part of employers to recognise, and, so far as may be practicable, to meet it.

The sum of the whole matter is, that the worker's share in agriculture, and his position in the industry, will be determined in the long run by the general spirit of the relationship which exists between him and his employer, rather than by the precise definition of the terms of the relationship. Mutual respect, and confidence and consideration, cannot be defined, but it is in the cultivation of these qualities that the best outlook for the future lies, and where they exist there will be real co-operation for the promotion of the best interests of all engaged in the cultivation of the land.

THE IMPROVEMENT OF LIVE STOCK IN ENGLAND AND WALES.

REPORT FOR THE YEAR 1918-19.

THE future of British agriculture is a matter of uncertainty. The period of abnormal conditions, of fictitious values, of depleted labour and material, through which the country has just passed, has left agriculturists in a state of doubt as to what are the best lines to follow in reconstructing and developing an industry to which the War has given a revived importance.

The live stock industry has not escaped the adverse effects of War, but the outlook is probably more encouraging than

in many other sections of agriculture. There is every indication that the breeder of good stock will continue to secure a market for his surplus animals at remunerative prices for some time to come, provided his customers—*i.e.*, the producers of meat and milk—are able to carry on their business at a profit. Breeders will be well advised, therefore, to take all possible steps to secure increased production of high-class stock as part of the commercial reconstruction of the country. Such action should prove of financial advantage to themselves and tend to the welfare of the Nation.

The Live Stock Scheme was not a war measure. It was introduced to grade up the inferior stock of the country by the introduction of more systematic and careful methods of breeding, of which many farmers knew little, or to which they were lamentably indifferent. The Scheme seeks to achieve its purpose by educating farmers to the use of sound pedigree sires and to the keeping of records of the milk yield of their cows, and financial assistance is provided to bring these methods within the reach of the smaller farmers.

It was unfortunate that the introduction of the Scheme almost synchronised with the outbreak of the War. Its experimental stage has consequently been conducted under abnormal and adverse conditions, which have made progress more difficult than would otherwise have been the case. On the other hand, the War has accentuated the national importance of the live stock industry, and has demonstrated only too clearly the need of such a scheme to increase the home production of food by increasing the producing capabilities of our farm stock.

In view of war conditions it is not surprising to find that the Scheme has not made much headway in some districts, but in those areas where it has been taken up there is encouraging evidence that it promises to achieve the objects in view.

The process of improvement must necessarily be gradual, but the Live Stock Officers report, and the societies concerned bear testimony to the fact, that some improvement in the quality of cattle is already to be noticed in those districts where the Scheme has operated for five years. In some directions, notably in milk recording, there is evidence to prove that there is financial profit to be derived from the adoption of the Scheme. No other form of inducement is more likely to appeal to farmers and encourage them to give trial to new methods.

The progress of a scheme such as the Live Stock Scheme cannot be adequately expressed in figures, and while the returns given in this Report are, on the whole, encouraging, it should be remembered that they only partially represent what has been accomplished. It is satisfactory, for example, to know that the number of pedigree sires located under the Scheme has increased annually, but the result is more satisfactory, as for every sire so located, a number of farmers, varying from 10 upwards, are receiving a practical demonstration of the advantages of good breeding. Many breeders, too, have purchased pedigree cows and heifers to mate with the Premium bulls, and not a few members of milk recording societies have become the owners of good-class bulls of milking strains.

The year under review—*i.e.*, the year ending 31st March, 1919—completes the quinquennial period for which the Development Commissioners undertook to finance the Scheme. The following table shows the progress made annually during the 5 years of probation, and though it is too early yet to expect any marked improvement in the stock bred under the Scheme, the results obtained have satisfied the Board that the Scheme has justified its existence, and they have decided to continue it as one of their normal activities, and to extend and develop it as opportunity offers.

Year 1st April to 31st March, except for 1914-15, which is for period 1st February, 1914, to 31st March, 1915.			Boars.			Bulls.			Horses.		Milk Recording.	
			Societies.	Individuals.	Boars.	Societies.	Individuals.	Bulls.	Societies.	Stallions.	Societies.	Cows.
1914-15	..	..	115	Nil	115	369	43	497	65	72	16	7,331†
1915-16	..	..	180	Nil	193	489	28	633	88*	97*	20	9,811
1916-17	..	..	186	15	216	543	15	659	93*	108*	22	12,950
1917-18	..	..	172	92	264	578	14	710	94*	110*	25	14,404
1918-19	..	..	156	167	350	604	7	721	101*	122*	27	19,793

* Excluding the Cumberland and Westmorland Heavy Horse Society, formed in 1915-16.

† The milk recording figures for 1914-18 are for years from 1st April to 31st March, those for 1918-19 for year from 1st October to 1st October.

It may be of interest to compare some of the prices and service fees paid for the sires in respect of which particulars are available during the first and fifth years of the operation of the Scheme. In the financial year 1914-15 115 boars averaged £7 each, whereas in 1918-19 327 boars averaged £13 each. In the former year the service fee was 2s. 6d. or less for 92 boars, over 2s. 6d. but less than 5s. for 21 boars, and in only two instances was it as much as 5s. In the year 1918-19 the fee

for 64 boars was 2s. 6d. or less, over 2s. 6d. but less than 5s. for 149 boars, 5s. for 95 boars, and over 5s. for 19 boars.

The bull figures show that in 1914-15 the average cost of 497 bulls was £36, whereas the average for 689 bulls in 1918-19 had risen to £61. In the former year 408 of the service fees were under 5s. and only 89 were over that amount; in the latter year the comparative figures were 404 and 285.

From the stallion returns it appears that the average hiring fee in 1914-15 for 72 stallions was £232 and the average service fee £2 8s., and similar figures for 122 horses for 1918-19 were £285 and £2 15s.

Progress in the development of the Milk Recording Scheme was difficult under war conditions, and it is not unsatisfactory to find that the number of cows recorded in 1918-19 was 19,793 as compared with 7,331 in 1914-15.

Grants for Boars.—The high price of feeding stuffs and the difficulty in obtaining them during the War affected the pig-keeper more than any other owner of live stock. The result was that many breeding sows were slaughtered, and the number kept in some districts became so few that the keeping of a boar proved an unremunerative business.

The Live Stock Officers were, however, successful in persuading many of the boar owners under the Scheme to continue to provide approved sires, and the provision of these high-class boars at reasonable fees encouraged many small farmers to continue to breed pigs which they would not have done otherwise in the times when pig breeding was not as profitable as it is to-day.

The continuation or formation of boar societies, which at no time is an easy matter, was specially difficult during the War owing to the general unwillingness of farmers to provide or keep a boar solely for the use of members of a society, and to the fact that they regarded the annual grant of £3 as an insufficient inducement for them to do so.

The Board decided, therefore, to offer grants to individual boar owners as well as to societies for approved sires. This amendment of the Scheme had the desired effect and brought about a substantial increase in the number of boars, and as pig keeping becomes more general there will be an increased demand for the services of high-class boars such as are provided under the Scheme.

An instance was brought to the notice of the Board in which a boar provided under the Scheme at a cost of £10 10s. was eventually deemed too valuable for use on cross-bred sows, and

was sold for 80 guineas to go into a pedigree herd. The average price of the boars located during the year was £13 2s. 7d., as compared with £9 6s. 8d. in the previous year. The increase is due largely to the higher prices ruling for stock, and does not indicate, of course, that the standard of sire provided has improved to a corresponding degree. On the other hand the fact that two boars located during the year were purchased at £52 11s. and £42 1s., respectively, does suggest that owners are willing to pay a higher price for a well-bred boar than was formerly the case.

The service fees charged for the use of the boars varied from 2s. to 10s. and showed a higher average than in previous years.

The number of boars subsidised during 1918-19 was 350, an increase of 86 on the preceding year. Of the 350 boars located, 137 were Large White, 101 Large Black, 35 Gloucester Old Spots, 24 Middle White, 23 Lincoln Curly Coat, 16 Cumberland, 10 Berkshire and 4 Large White Ulsters.

Grants for Bulls.—It is customary in most societies for a bull to be used for service for two years and then to be sold to the butcher. When the price obtained for slaughter equals or exceeds the amount a bull originally cost for breeding purposes the owner is satisfied, but he is not so pleased if the bull is disposed of for less than the cost price.

In the first year of the Scheme the average cost of a "Government" bull was only £36, and the purchaser therefore ran but little risk of depreciation. The venture at the present time is far more speculative, as a similar animal costs over £60 and the grant payable to its owner is not increased.

The Live Stock Officers report, moreover, that the service fees for approved bulls cannot be raised by any considerable amount, owing to the competition of mongrel sires at low fees.

This question of the initial outlay is becoming the chief difficulty experienced in the formation and maintenance of bull societies and is becoming more acute every day as the price of suitable sires continues to rise.

Farmers in many dairying districts dispose of their calves as soon as possible after birth, irrespective of the price they fetch, and are content, therefore, to serve their cows with as cheap a bull as they can obtain.

This practice is not new, but the high price of milk is causing it to spread, and this makes the location of bulls suitable for improving dairy herds increasingly difficult, and useless in localities where the calves are sold for slaughter.

It is satisfactory, therefore, to find that more bulls were located than in the previous year, and that there has been a steady increase in the number of bull societies since the Scheme was started.

For the reasons stated it is not, however, anticipated, unless conditions alter, that there will be any rapid increase in bull societies in the immediate future, and it is possible that some societies will cease to exist.

Reports received by the Board show that the Scheme is improving the quality of the stock bred in the districts in which the Premium bulls are located. There is evidence that the progeny of subsidised bulls command higher prices at sales than those got by nondescript sires. It was reported to the Board that at one sale a young bull realised 120 guineas and a heifer 160 guineas, both animals being sired by Premium bulls. In another case a bull calf got by a subsidised bull was sold for 360 guineas, while a Live Stock Officer reported that a bull which had been subsidised under the scheme sired subsequently nine bull calves which sold for an average of 511 guineas.

Such instances bring home to farmers the financial advantages of using high-class sires, and in many societies members have purchased pedigree females in order to put to such sires to grade up their herds.

The number of bulls located at the end of the year 1918-19 was 721, as compared with 710 in the previous year. Of these, 714 were provided by 604 societies, and 7 by individual owners.

The average prices paid for the bulls were as follows:—Devon £64 18s. 7d., Shorthorn £63 7s. 9d., Lincoln Red £60 12s. 2d., South Devon £59 1s. 4d., Hereford £57 4s. 5d., Welsh Black £42 9s. 5d., other breeds £45 7s. These prices show an average increase of about £8 on last year's amounts. The service fees paid varied from 2s. 6d. to 10s. 6d. and showed, on the whole, a higher average than in the previous year.

Of the 721 bulls located, 446 were Shorthorn, 79 Hereford, 71 Lincoln Red, 61 Devon, 43 Welsh Black, 13 South Devon, 2 Aberdeen-Angus, 2 Jersey, 2 Guernsey and 2 Sussex. The choice of breed rests with members of a society and the Board do not, as is sometimes supposed, dictate to a society what type of sire is to be used by the members.

Heavy Horse Grants.—No section of the Scheme has been more popular than that under which grants are made for heavy stallions, and there is little doubt that a larger sum could be spent to advantage in most counties on the improvement of heavy horses, if funds were available.

Heavy Horse Societies are authorised to choose the breed of stallion they think most suitable to the district, and to select and hire, without having to obtain the Live Stock Officer's approval, any sire they fancy.

Many societies, however, consult their Live Stock Officer as to the suitability of the horse they propose to hire, and most of them, doubtless, are careful to pick from their members men who are regarded as good judges of a horse to act on the stallion selection committee.

It is probable, owing to these reasons, and to the fact that only horses that have been registered by the Board of Agriculture are eligible for a grant, that but few stallions travelled under this Scheme are reported on by the Live Stock Officer as being unsuitable.

The cost of hiring a stallion for the season has risen since 1914, but the Live Stock Officers report that the standard of sires has not been lowered, and that the foals got by the preceding year's services show good quality and realise good prices.

A feature worthy of note is that of the 101 societies subsidised for the season of 1918 only 17 were in existence prior to the introduction of the Scheme. This shows that farmers can be induced to combine for their common benefit when a practical demonstration proves to them that co-operation puts money in their pockets.

In several cases societies have prospered sufficiently well to enable them to carry on without further financial assistance from the Board.

Very few subsidised societies have "come to grief" owing to financial difficulties, and probably this is because the Board insist on (1) societies hiring stallions for the season instead of buying them, (2) the service fee being fixed with due regard to the hiring fee, (3) foal returns being furnished with a view of ascertaining the foal-getting record of the stallions hired, and (4) an audited statement of accounts being furnished to the Board each year. In short, financial stability is due to the societies being conducted on business lines.

The formation of these 84 new Heavy Horse Societies has, no doubt, proved of benefit to owners of pedigree horses, as they probably prefer to let stallions to societies for an agreed sum of which they are assured rather than to travel their own horses and collect the fees—a somewhat difficult and speculative business at times.

The number of societies subsidised for the 1918 season was 101 with 122 stallions, as compared with 94 societies and

110 stallions in 1917. The number of mares served was 12,281, an average of 100 per stallion, as compared with 10,556 and an average of 96 in 1917. Assisted nominations (*i.e.*, payment not exceeding one-half the normal service fee) were paid by the Board in respect of 2,165 mares. From the returns received 60 per cent. of the mares served in 1917 proved in foal.

The average hiring fee of the 122 stallions was £285 as compared with £258 in the previous year. The increase is probably not so great as a comparison with current hiring fees would reveal, and in response to many representations in this connection the Board have agreed to a maximum service fee of £4 4s. instead of £3 3s. for the current season. The average service fee paid during the 1918 season was £2 15s. 8d.

The above figures do not include reference to the Cumberland and Westmorland Heavy Horse Society, as they do not hire stallions. They issue assisted nominations to mares belonging to small farmers for service by selected stallions. During the year under review 321 nominations were issued to 46 stallions.

Grants to Milk Recording Societies.—The progress made in this Section of the Live Stock Scheme during the year under review was encouraging, and the Milk Recording Scheme seems at last to have got well under way, and shows promise of considerable extension.

In 1917 the Board decided that it was desirable that all the Milk Recording Societies under the Scheme should operate for a uniform year—1st October to 1st October. Uniformity was essential to the issue of the Board's Register of Dairy Cows, and it will enable comparison to be made of the results of the operations of the various societies. The number of societies operating for the year ended 1st October, 1918, was 27, with 639 members, 708 herds and 19,793 cows, as compared with 22 societies, 441 members, 495 herds, and 12,950 cows in 1916-17. The increase is not unsatisfactory if regard is had to the difficulty of forming and running a society in war-time. It is interesting to note that whereas the number of societies has increased by about 25 per cent. the number of cows has increased by nearly 50 per cent. This is partly due to the tendency to form large county societies with different branches, rather than several local societies in one county.

The statements of accounts furnished by the societies afford evidence of the variation of the cost of running a society in different parts of the country. The cost to a society per cow

ranged from 1s. 6d. to 7s. 4d., and the cost to the member per cow from 11d. to 4s. 10d. Local conditions are responsible to some extent for these marked differences, but the chief factor is the salary paid to Recorders and Secretaries. This varies considerably, and the travelling expenses of a Recorder are higher in some districts than in others owing to the distribution of the herds of the members. Those who are called upon to contribute at the low rate of 11d. per cow are very fortunate, for the Scheme is now showing that the benefits to be derived from it are worth a much higher contribution, and a payment of 5s. per cow is not excessive. The commercial value of the Board's certificate, and of entry in the Register of Dairy Cows, is becoming more generally recognised, and with it the opposition to the payment of adequate levies and to some of the regulations of the Board is fast disappearing. Regulations become less irksome when financial advantages accrue from the observance of them, and as indication of the value of milk recording the following examples may be cited. At one sale the auctioneers expressed the opinion that the cows disposed of made from £15 to £20 more than they would have done if sold without the Board's certificate. In another case two non-pedigree cows with certificated milk records realised £175 and £147 respectively. Prominence is now being given in many sale catalogues to the records of cows owned by members of Milk Recording Societies, and the more progressive societies are not slow to realise the advantage of such advertisement, and there is a growing movement among them to organise special sales for recorded cows.

The number of milk-record certificates issued by the Board for the year under review was 4,178 to 416 members, as compared with 2,189 to 230 members in the preceding year. Of these certificates two were in respect of cows (1 Friesian and 1 Shorthorn) whose yields were over 15,000 lb.; four (1 Friesian and 3 Shorthorn) of cows with yields between 14,000 and 15,000 lb., eight (1 Friesian and 7 Shorthorn) of cows whose records were over 13,000 lb., but under 14,000. The number of cows who had records between 10,000 and 13,000 lb. was 210. There were 1,047 cows which yielded between 8,000 and 10,000 lb., 1,031 between 7,000 and 8,000 lb., and 1,099 cows with yields over 6,000 lb. and under 7,000. The remaining 777 cows had yields not exceeding 6,000 lb.

Register of Dairy Cows.—The number of cows entered in Volume II. of the Board's Dairy Register is 1560 as compared

with 572 in Vol. I. Of this number 1,118 are Shorthorn, 143 Cross-bred, 130 Friesian, 124 Lincoln Red, 33 Red Poll, and the remaining 12 are of seven different breeds.

The increased entry is an index of the growing appreciation of the value of the Register, and is due also to the fact that in addition to the entry of cows with certified yields of 8,000 lb. or over for the current year cows have also been admitted which have an annual average of 6,500 lb. or over on their certified yields for the last two years.

The Register is not intended to rank as a Herd Book. Its main object is to encourage the keeping of authenticated milk records and the breeding of high-class dairy cattle, and it should prove of assistance to those breeders who are desirous of grading up their dairy herds.

Some of the societies which are now operating under the Milk Recording Scheme have adopted the valuable practice of marking calves out of recorded cows, and the Board hope to arrange at an early date for a uniform system of marking for all societies.

There is reason to think that when conditions become more normal milk recording will be more readily taken up, but at present records are only kept in a very small percentage of the dairy herds of the country. It is hoped, however, that farmers will soon realise that periodical weighing is the only reliable method of ascertaining the amount of milk produced by a cow, and that if they are to carry on their business to full advantage they must satisfy themselves not only as to the quantity of milk produced, but as to its quality and the cost of its production. These are factors of great importance to dairy farmers if they are to derive full benefit from their industry.

In the Appendices will be found particulars of the societies arranged according to the Provinces into which the country has been divided.

The following are the principal memoranda used in connection with the live stock operations of the Board, and copies of them can be obtained, free of charge, on application to the Secretary, Board of Agriculture and Fisheries, 4, The Sanctuary, Westminster, London, S.W. 1.—

- L. 2. Bull Grant Regulations.
- L. 3. Horse Grant Regulations.
- L. 4. Milk Recording Regulations.
- L. 11. Boar Grant Regulations.

APPENDIX A.

Statement showing the Breeds of Boars located under the Scheme at the end of the Year 1918-19, and the Average Prices.

Province.	Berkshire.		Gloucester Old Spot.		Large Black.		Lincoln Curly Coat.		Large White.		Middle White.		Other Breeds.		All Breeds.	
	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.
1. Northern—(Cumberland, Durham, Northumberland, Westmorland) ..	—	£	—	£	—	£	—	£	—	£	—	£	—	£	—	£
2. Lancashire and Cheshire ..	—	—	—	—	2	10	—	—	—	—	—	—	—	—	6	12
3. Yorkshire ..	—	—	—	—	2	14	1	13	—	—	—	—	—	—	19	14
4. West Midland—(Salop) ..	—	—	—	—	6	10	1	13	5	14	7	13	3	12	22	12
5. Staffs, Warwick, Leicesters, Derby, Leicesters, Lindsey (Lines), Notts (Rutland) ..	—	—	2	12	5	13	—	—	21	13	2	27	—	—	30	14
6. Eastern—(Beds, Cambs, Essex, Herts, Hunts, Bedford, Bucks, Ely, Norfolk, Northants, Suffolk, Peterboro', East Suffolk, West Suffolk) ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7. South-Eastern—(Kent) ..	—	—	—	—	5	11	3	12	12	20	1	17	—	—	21	17
8. Surrey, Sussex ..	1	7	1	16	17	12	—	—	6	13	8	15	—	—	33	13
9. Southern—(Berks, Bucks, Dorset, Hants, Isle of Wight, Middlesex, Oxford) ..	6	14	1	11	9	11	1	16	1	17	2	15	—	—	20	13
10. Western—(Gloucester, Wiltshire, Somerset, Wilts, Worcester) ..	1	26	16	13	12	11	1	11	18	12	1	15	—	—	49	12
11. Devon and Cornwall ..	—	—	1	11	16	10	—	—	4	12	1	13	—	—	22	11
England	8	14	22	12	79	11	22	13	85	14	22	16	18	13	236	13
12. South Wales—(Brecon, Cardigan, Carmarthen, Glamorgan, Monmouth, Pembroke, Radnor) ..	1	6	4	11	10	10	—	—	26	12	1	13	—	—	42	11
13. North Wales—(Anglesey, Carnarvon, Denbigh, Flint, Merioneth, Montgomery) ..	—	—	3	8	9	12	1	12	15	10	1	7	—	—	29	10
Wales	1	6	7	10	19	11	1	12	41	11	2	10	—	—	71	13
England and Wales ..	9	13	29	12	98	11	23	13	126	13	24	15	18	13	327*	13
Number and Average cost of Boars during the first year of the Scheme, ended 31st March, 1915 ..	10	8	7	7	18	7	4	8	64	7	12	7	—	—	115	7

* 550 Boars were located at the end of 1918-19, but particulars as to prices, etc., of 23 were not available for this Table.

APPENDIX B.

Table showing the Service Fees of Boars located under the Scheme at the end of the Year 1918-19.

Province.	Amount of Service Fees.												Total Number of Boars.
	1/-	1/6	2/-	2/6	3/-	3/6	4/-	4/6	5/-	6/-	7/6	10/-	
1. Northern—(Cumberland, Durham, Northumberland, Westmorland) ..	—	—	—	—	2	—	1	—	1	—	2	—	6
2. Lancashire and Cheshire ..	—	—	—	—	—	—	1	—	13	3	2	—	19
3. Yorkshire	—	—	—	7	1	—	4	—	8	1	—	1	22
4. West Midland—(Salop, Staffs, Warwick) ..	—	—	—	1	2	25	2	—	—	—	—	—	30
5. Midland—(Derby, Leicester, Lindsey (Lincs), Notts, Rutland) ..	—	—	—	—	2	2	8	1	17	4	—	—	34
6. Eastern—(Beds, Cambs, Essex, Herts, Hunts, Holland (Lincs), Isle of Ely, Kesteven (Lincs), Norfolk, Northants, Soke of Peterboro', East Suffolk, West Suffolk) ..	—	—	—	1	4	9	—	1	5	—	1	—	21
7. South-Eastern—(Kent, Surrey, Sussex) ..	—	—	—	—	1	3	1	—	26	1	1	—	33
8. Southern—(Berks, Bucks, Dorset, Hants, Isle of Wight, Middlesex, Oxford)	—	—	4	7	4	3	1	—	1	—	—	—	20
9. Western—(Gloucester, Hereford, Somerset, Wilts, Worcester) ..	—	—	2	17	16	7	—	1	6	—	—	—	49
10. Devon and Cornwall ..	—	—	—	6	7	6	1	—	1	1	—	—	22
<i>England</i>	—	—	6	39	39	55	19	3	78	10	6	1	256
11. South Wales—(Brecon, Cardigan, Carmarthen, Glamorgan, Monmouth, Pembroke, Radnor) ..	—	—	1	9	2	6	8	3	11	1	1	—	42
12. North Wales—(Anglesey, Carnarvon, Denbigh, Flint, Merioneth, Montgomery)	—	—	—	9	6	2	6	—	6	—	—	—	29
<i>Wales</i>	—	—	1	18	8	8	14	3	17	1	1	—	71
<i>England and Wales</i>	—	—	7	57	47	63	33	6	95	11	7	1	*327
Particulars of Service Fees for the first year of the Scheme, ended 31st March, 1915	3	6	21	62	10	5	6	—	2	—	—	—	115

* 350 Boars were located at the end of 1918-19, but particulars as to the Service Fees, etc., of 23 were not available for this Table.

APPENDIX C.

Statement showing the Breeds of Bulls located under the Scheme at the end of the Year 1918-19 and the Average Prices.

Provinces.	Devon.		Hereford.		Lincoln Red.		Shorthorn.		South Devon.		Welsh Black.		Other Breeds.		All Breeds.	
	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.	Number.	Average Price.
1. Northern—(Cumberland, Durham, Northumberland, Lancashire and Cheshire)	—	—	—	—	—	—	14	75	—	—	—	—	1	—	15	75
2. Yorkshire	—	—	—	—	—	—	39	66	—	—	—	—	—	—	39	66
3. Lancashire and Cheshire	—	—	—	—	—	—	61	62	—	—	—	—	1	—	62	62
4. West Midland—(Salop, Staffs, Warwick)	—	—	9	57	2	58	39	66	—	—	—	—	—	—	50	64
5. Midland—(Derby, Leicestershire, Lincoln)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6. Eastern—(Beds, Cambs, Essex, Herts, Hunts, Holland (Lincs), Isle of Ely, Kent (Lincs), Norfolk, Northants, Soke of Peterboro', East Suffolk, West Suffolk)	—	—	—	—	47	62	25	66	—	—	—	—	—	—	72	64
7. South-Eastern—(Kent, Surrey, Sussex)	—	—	—	—	17	56	20	51	—	—	—	—	—	—	37	53
8. Southern—(Beds, Bucks, Essex, Herts, Kent, Surrey, Sussex, Wilt, Dorset, Devon, Cornwall)	—	—	—	—	—	—	29	69	—	—	—	—	2	—	31	68
9. Western—(Gloucester, Hereford, Somerset, Wilt, Worcester)	14	64	14	61	—	—	37	55	—	—	—	—	2	—	42	55
10. Devon and Cornwall	43	65	—	—	—	—	54	60	—	—	—	—	1	—	83	61
							8	55	12	59	—	—	—	—	63	63
England	59	65	23	59	67	61	326	60	12	59	—	—	7	41	494	62
11. South Wales—(Brecon, Cardigan, Carmarthen, Glamorgan, Monmouth, Merioneth, Radnor, Glamorgan, Carmarthen, North Wales, Denbigh, Flint, Merioneth, Montgomery)	—	—	42	57	1	53	68	64	—	—	2	43	1	74	114	61
Wales	—	—	11	53	1	74	29	69	—	—	40	42	—	—	81	54
	—	—	53	56	2	63	97	66	—	—	42	42	1	74	195	58
England and Wales	59	65	76	57	69	61	423	63	12	59	42	42	8	45	689*	61
Number and Average cost of Bulls during the first year of the Scheme, ended 31st March, 1915	16	41	63	33	33	32	337	38	6	37	55	29	7	29	497	36

* 721 Bulls were located at the end of 1918-19, but the particulars as to price, etc., of 32 were not available for this Table.

APPENDIX D.

Table showing the Service Fees of Bulls located under the Scheme at the end of the Year 1918-19.

Province.	Amount of Service Fees.												Total Number of Bulls.
	2/6	3/-	3/6	4/-	4/6	5/-	5/6	6/-	7/-	7/6	10/-	10/6	
1. Northern—(Cumberland, Durham, Northumberland, Westmorland) ..	1	1	—	5	—	8	—	—	—	—	—	—	15
2. Lancashire and Cheshire ..	4	1	—	7	—	17	—	4	—	1	2	3	39
3. Yorkshire	19	8	3	6	—	22	—	—	—	3	1	—	62
4. West Midland—(Salop, Staffs, Warwick) ..	7	3	12	8	—	19	—	1	—	—	—	—	50
5. Midland—(Derby, Leicesters, Lindsey (Lincs) Notts, Rutland) ..	8	6	7	10	2	37	—	2	—	—	—	—	72
6. Eastern—(Beds, Cambs, Essex, Herts, Hunts, Holland (Lincs), Isle of Ely, Kesteven (Lincs), Norfolk, Northants, Soke of Peterboro', East Suffolk, West Suffolk) ..	—	—	2	—	—	25	—	6	3	1	—	—	37
7. South-Eastern—(Kent, Surrey, Sussex) ..	—	—	—	5	1	18	—	4	—	2	1	—	31
8. Southern—(Berks, Bucks, Dorset, Hants, Isle of Wight, Middlesex, Oxford)	23	4	4	7	—	3	—	—	—	1	—	—	42
9. Western—(Gloucester, Hereford, Somerset, Wilts, Worcester) ..	17	14	7	9	3	31	1	1	—	—	—	—	83
10. Devon and Cornwall ..	4	13	10	11	1	20	—	3	—	1	—	—	63
<i>England</i>	83	50	45	68	7	200	1	21	3	9	4	3	494
11. South Wales—(Brecon, Cardigan, Carmarthen, Glamorgan, Monmouth, Pembroke, Radnor) ..	27	14	14	26	1	29	—	1	1	1	—	—	114
12. North Wales—(Anglesey, Carnarvon, Denbigh, Flint, Merioneth, Montgomery)	42	14	6	7	—	11	—	—	—	—	1	—	81
<i>Wales</i>	69	28	20	33	1	40	—	1	1	1	1	—	195
<i>England and Wales</i> ..	152	78	65	101	8	240	1	22	4	10	5	3	*689
Particulars of Service Fees for the first year of the Scheme ended 31st March, 1915	265	57	41	42	3	88	—	—	—	1	—	—	497

* 721 Bulls were located at the end of 1918-19, but the particulars as to Service Fee, etc., of 32 were not available for this Table.

APPENDIX E.
Statement as to the Number of Heavy Horse Societies and of the Stallions hired by them for the Season of 1918.

Province.	Number of Societies.	Number of Stallions.	Average Hiring Fee.	Average Service Fee.	Number of Nominations Issued.					
					Total Services.		Average Services.			
					Ordinary.	Assisted.	Total.	Ordinary.	Assisted.	Total.
1. Northern—(Cumberland, Durham, Northumberland and Westmorland)	4	6	f 262 3 2 6	f s. d. 3 2 6	552	87	639	92	114	106
2. Lancashire and Cheshire	11	11	208	2 13 2	790	336	1,126	72	30	102
3. Yorkshire	8	10	252	2 7 10	731	102	833	73	110	83
4. West Midland—(Salop, Staffs, and Warwick)										
5. Midland—(Derby, Leicester, Lindsey (Lincs), Notts and Rutland)	7	7	285	2 18 2	577	136	713	82	20	102
6. Eastern—(Beds, Cambs, Essex, Herts, Holland (Lincs), Hunts, Isle of Ely, Kesteven (Lincs), Norfolk, Northants, Sole of Peterboro', East Suffolk and West Suffolk)	15	20	314	2 19 5	1,877	195	2,082	94	10	104
7. South-Eastern—(Kent, Surrey, East Sussex and West Sussex)	5	8	294	3 3 0	721	35	756	90	14	94
8. Southern—(Berks, Bucks, Dorset, Hants, Isle of Wight, Middx, and Oxford)	8	9	294	2 9 2	805	77	882	89	19	98
9. Western—(Gloucester, Hereford, Somerset, Wilts and Worcester)	13	17	256	2 14 7	1,417	290	1,707	83	17	100
10. Devon and Cornwall	6	7	317	2 17 6	567	181	748	81	26	107
England	77	95	286	2 16 0	8,047	1,439	9,486	85	15	100
11. South Wales—(Brecon, Cardigan, Carmarthen, Glamorgan, Monmouth, Pembroke, and Radnor)	13	15	285	2 12 0	1,160	442	1,602	77	30	107
12. North Wales—(Anglesey, Carnarvon, Denbigh, Flint, Merioneth, and Montgomery)	11	12	275	2 13 5	909	284	1,193	76	24	100
Wales	24	27	281	2 12 8	2,069	726	2,795	76	27	103
England and Wales	101	122	285	2 15 3	10,116	2,165	12,281	83	17	100
Particulars for Season 1914	65	72	232	2 8 0	4,830	1,512	6,342	67	123	90

* Exclusive of the Cumberland and Westmorland Society.

† Five Societies issued no Assisted Nominations.

APPENDIX F.

Table giving Particulars of the Operations of the 27 Milk Recording Societies for the Year ended 1st October, 1918.

County.	Identifying Mark.	Number of Members during the Year.	Number of Herds during the Year.	Number of Cows and Heifers during the Year.	Particulars of all the Cows and Heifers in the Herds during the Year.			Particulars of Cows in the Herds for the full Year.		Certificates.		Dairy Register.		Cost of Receiving per Cow for the Year to	
					Total Yield of Milk.	Average Yield of Milk.	Highest Yield of Milk.	Number of Cows.	Total Yield of Milk.	Average Yield of Milk.	Number of Members who received Certificates.	Number of Members whose Cows were entered.	Number of Cows entered.	Society.	Member.
Bedford	T	19	24	568	2,895,701	5,098	12,658	286	1,909,260	6,679	16	202	11	72	s. d.
Cambridge	V	21	22	779	3,913,772	5,024	12,634	450	2,930,533	6,512	19	241	16	126	3 1
Cheshire	G	24	26	918	4,390,165	4,782	12,828	460	2,793,108	6,050	10	104	8	61	1 10
Cumberland	P	56	56	802	2,667,945	4,028	11,484	278	1,792,028	5,744	47	291	31	77	2 11
Derby	U	16	17	534	2,667,945	4,996	11,484	278	1,819,305	6,544	15	142	14	68	3 4
	C	24	24	560	2,667,945	4,574	12,410	274	1,671,291	6,100	15	135	12	37	2 2
Devon	*AL	24	24	565	1,407,731	2,491	9,014	Nil	—	—	13	157	1	4	1 11
Essex	O	16	17	640	3,568,170	5,481	13,701	407	2,658,142	6,531	13	157	10	42	2 3
Gloucester	AD	13	13	248	1,179,005	4,754	13,179	533	799,546	6,512	9	—	2	4	1 8
Hants	*Z	17	23	850	Not finished.	—	—	—	—	—	—	—	—	4	7
Kent	W	34	37	1,108	6,113,133	5,110	13,604	701	4,216,720	6,015	24	332	18	119	4 11
Leicestershire	X	38	43	1,716	6,918,630	4,032	13,564	602	3,648,844	6,028	29	201	15	72	3 3
Lincolnshire	B	21	23	593	2,919,524	4,907	13,319	314	1,900,141	6,051	17	133	17	81	4 4
Northfolk	AB	21	23	1,042	5,119,892	4,952	13,751	487	3,279,880	6,735	16	282	7	106	1 11
Northants	AC	21	21	539	2,474,939	4,502	12,954	198	1,209,853	6,110	16	99	12	39	2 1
Northumberland	*AG	21	21	539	549,338	3,104	7,783	Nil	—	—	4	—	—	7	4 10
Notts	S	12	12	529	2,177,480	3,116	10,255	197	1,121,808	5,694	—	—	—	—	—
Oxford	M	22	27	1,125	5,827,579	5,180	14,740	674	4,290,482	6,366	22	448	9	21	1 0
Somerset	D	26	35	913	3,921,837	4,296	12,162	484	2,850,574	5,890	20	257	17	182	2 0
	A	26	35	558	2,767,710	4,960	10,783	319	1,964,876	6,128	21	241	17	151	1 11
Suffolk	Y	36	45	1,423	6,877,840	4,674	13,494	820	4,875,358	5,945	22	267	13	85	3 0
	AE	16	17	646	3,019,414	4,674	11,161	395	2,248,270	5,692	22	167	13	31	2 0
Westmoreland	K	20	23	679	3,580,434	3,234	12,244	404	2,818,260	6,974	12	167	10	23	3 6
Wills	*K	20	20	305	1,423,896	3,898	11,644	Nil	—	—	9	36	8	10	1 5
Worcester	*H	11	12	829	2,451,032	2,956	7,423	101	1,240,948	6,445	10	159	10	70	3 11
Yorkshire	N	27	29	461	2,025,538	4,434	13,372	150	1,003,119	6,687	14	104	6	36	4 11
Totals	27	639	708	19,793	81,968,199	4,717	15,701	8,775	53,873,217	6,139	416	4,178	284	1,560	—

* These four Societies did not operate for the full year, and are excluded from the calculations as to the yield of milk.

INCREASED PRODUCTION OF GRASS.

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THE use of artificial manures for grass is now recognised as a profitable means of improvement of land and increased production, with advantages over yard manure at least in economy of labour and improved quality. The object of this article is to put before the practical man in a concise form an epitome of the facts which have been gained from a careful examination by the writer of the results of most of the very numerous and scattered experiments on hay conducted up to date in England for many years—mainly in the Midlands and North—aided by personal experience. The comparative merits of the leading manures have been approximately gauged, with reference to cost, as well as to weight, of hay. The figures under "Increase and Profit" are average ones. Particular attention is directed to potash and phosphate if these manures can be obtained, both for economy and all-round excellence.

As with all cases of special manuring, good crops may be obtained from mixtures which do not pay for using, owing to their high cost. This is a point which has unfortunately often not been directly brought out in experiments, and which should always be specially kept in mind when nitrogenous fertilisers are employed. The writer has kept this point and suitability of soil prominently before him, though the profits shown are necessarily those derived from manure prices current at the time of the experiments, which are mostly pre-war, and from hay prices at 50s. (mostly) and 60s. per ton, and may, therefore, probably show some discrepancy at current rates. No account is taken of aftermath or residual values, but the latter in long series of experiments are necessarily included in the many cases where the plots are unchanged.

Many kinds of soils are included, more especially the stronger types, and the relative merits are based, where possible, on strictly comparable results, and often on individual as well as average results where series comprise, as they often do, various centres. A feature of this manuring of much value at the present time is the smallness of the most profitable dressings. Want of attention to this may result in loss instead of profit, and a smaller area manured.

(1) MEADOW HAY.

Comparative Value of Manures.—As the relative merits of the manures vary in different localities it is difficult to assign

more than an approximate estimate of their value, and the following table has been drawn up more as a guide to average merit than from excellence in any particular series of experiments, prices being reckoned on the basis mentioned.

<i>Increase of Crop.</i>	<i>Amount of Profit.</i>
1. Complete manure.	1. Complete.
2. Nitrogen and phosphate.	2. Potash and phosphate.
3. Potash and phosphate.	3. Nitrogen and phosphate.
Potash and nitrogen.	Nitrogen and potash.
Phosphate only.	4. Nitrogen only.
4. Nitrogen only.	
5. Potash only.	

There is not, however, any marked difference between the first three lots, and except the superior yield of No. 1 and some exceptional returns from slag, they come very close together. Profit, therefore, turns a good deal on cost of nitrogen.

Complete Artificials.—A vast amount of experiment shows these to be invaluable, at least on run-down soils of all kinds, with almost a certainty of a bigger increase than with other mixtures. Cost is the one drawback, but this dressing pays very generally, though, where potash is not wanted, it may be unprofitable (as in 4–5 years in Wiltshire,* where it ranks about fourth, though first in yield, and many of the recent Western Counties' trials). In Ireland,† for 13 years and at over 200 centres, it is put unreservedly first, with a far higher profit (14s.) than dung. It is profitable, too, on fertile soils. Aftermath and quality are of the best, and the ground is not "drawn," but on purely slag soils and in special cases it is not advisable to use it. Generally speaking, any of the common forms of nitrogen and phosphate, except bones, seem to be of much the same value, and, as with seeds, the form of potash appears to be immaterial.

Amount of Manure.—Moderate dressings (1 cwt. nitrate, 3 cwt. superphosphate, 2–3 cwt. kainit) are safest, at any rate of nitrogen, and over 1 cwt. of nitrate may be less profitable, or a loss.

Increase and Profit.—Increase not frequently over 15 cwt., and profit rarely £1 per acre, and generally nearer 10s.

Nitrogen and Phosphates.—This combination comes very generally a good second so far as increase is concerned, and this, whether nitrate of soda or sulphate of ammonia is used, superphosphate or slag. It is perhaps the most reliable mixture

* Wilts. County Council Agricultural Education Committee, 1911–1914 Reports, and Bristol Province Reports, 1914.

† Irish Department of Agriculture *Journal*.

that can be used, as results are uniformly good, which is more than can be said when potash is included in a mixture, this manure being by no means always necessary. Quality is good, if not quite of the best, and it is suitable to many kinds of land. Examination of a great number of centres shows that it generally pays well, coming out first in 3 or 4 years out of five (second in yield) in the extensive Wiltshire experiments on both light and heavy land, most of which were duplicated.

Amount of Manure.—Manuring up to $1\frac{1}{2}$ cwt. of nitrate shows a very fair profit, but 1 cwt. is more general, and up to 5 cwt. of slag or 3 cwt. of superphosphate. On the whole the crop is appreciably less than with a complete dressing, and the profit rather less, but not always.

Increase and Profit.—About 10–11 cwt. per acre and 4s. to 6s., but £1 to 26s. 6d. at 3 main centres.*

Potash and Phosphate.—This is undoubtedly one of the very best and safest mixtures, certainly the second-best all-round one. It is very reliable, and seldom gives an indifferent return on any class of land, and the quality is the best of all. Either superphosphate or slag with kainit, or superphosphate and sulphate of potash, have been mostly used, and can be trusted to show a profit as a rule, as has been the case also with sulphate or muriate of potash with slag. The profit from superphosphate is by no means confined to sandy and other light land, nor of slag to heavy land.

The increase is rarely as much as a ton, or the profit £1, but nearer half these figures. On heavy, though very poor, land superphosphate may do better than slag in the mixture, provided there is plenty of lime (in the soil), which is a help to this combination. On heavy land of poor quality,† or if run-out, or wet and matty and mossy, superphosphate and sulphate of potash have sometimes proved of much value (with or without $\frac{1}{2}$ ton ground lime) in increasing live weight or milk on 3- to 4-acre plots, where successful, initial cost being 25s. to 45s. per acre. Live weight increase has been up to 68 lb.‡ and milk increase 80–90 gal.§ per acre per annum. The use of potash in such grazing trials has, however, so far generally

* Cransley, Cockle Park and Sevington, *vide Journal Supplement No. 10*, but hay at 50s. per ton here.

† At Saxmundham, on a limy soil, with 5 cwt. doses of slag, and 7 cwt. doses of superphosphate, but not with 10 cwt. doses of slag. Difference in favour of superphosphate over 12 years, £3 15s. 8d. per acre (hay at 50s. per ton). East Suffolk Education Committee, 15, 1915.

‡ Edinburgh and East Scotland College of Agriculture, Report 23 (Mutton).

§ Midland Agricultural and Dairy College Bulletins, 1, 2, 1910–12 (Manuring for Milk). See also Harper-Adams College experiments.

been a failure financially, shown especially in the disastrous results on light, upland (Scotch) pastures, where the yield has sometimes been reduced (see *Highland Society's Transactions*, etc.).

Evidence is, none the less, accumulating of the profit attached in practice to potash on sand* and chalk,† when used with slag or superphosphate, but experiments here are generally in hay, and it must ever be remembered that even for hay, superphosphate, or especially slag, used alone, has often given a better monetary return, even sometimes on sand (Ripley). These grazing experiments are very valuable, as they are on a big scale and practically managed. As already remarked, soil lime is especially useful with this combination of manure, and farmers on Cornbrash and Oolite formations rich in lime have benefited much from this dressing. (See University College, Reading, Bulletin No. 15.)

On peat,‡ potash and phosphate sometimes pay well, 10s. or more per acre having been recorded from grazing, and £4 to £5 per acre from hay in Sweden. Though so frequently mentioned in connection with light land, the most profitable records in hay are from strong land, *e.g.*, 39s. on very poor clay at Saxmundham, and 35s. on loam, and it is mainly on such land that a dressing of potash and phosphate has not infrequently beaten a complete mixture in a series over some years, and this in bulk as well as in profit. In very extensive trials over the Midlands up to date the mixture has rarely failed to give a profit.

Though placed second in profit it may easily be the most paying of all—quality and improved fertility considered—on lands where nitrogen has to be used with care, while it is usually cheap as well as economical, and for the outlay—sometimes as little as 10s. per acre—it undoubtedly gives the best return. It is sown in one operation. On gravel the Hook experiments on heather waste have shown extraordinary returns from slag and superphosphate used with potash and lime for hay, as have potash and slag at Wing (Bucks.).

Amount of Manure.— $\frac{1}{2}$ cwt. sulphate or muriate of potash and 2 to 3 cwt. superphosphate shows a profit, but highest returns come from heavier dressings at longer intervals, whether superphosphate or slag.

* See an account of remarkable results at Ripley, Surrey, by W. A. Cox in *Farm and Home*, 9th August, 1911, and "New Manuring for Mutton Experiments" (Edinburgh and East Scotland Agricultural College), 1912. Davy Houses Field, Cockle Park Guide.

† At Applesham, Sussex, and Sevington, and on Heddington Down, Devizes. See *Bath and West Journal*, 1910-11.

‡ Neglected Pastures, J. Struthers, West of Scotland Agricultural College.

Nitrogen and Potash.—This is a reliable and useful combination, probably (as is sometimes notably the case with seeds hay) less useful on heavy than on light soils, though either manure alone is sometimes ineffective or objectionable. The returns have been found very similar to the last combination. It has been found useful on cold, stiff clay (Wilts.) but it may there be unproductive or unprofitable (East Suffolk, Bicester,* etc., Cockle Park). Either form of nitrogen is useful; it was second in profit in one 5-years series. (See also under "Quality," p. 616).

Single Manures.—As a rule these yield far less than mixtures, except at times phosphates, and even on real slag land mixtures seem to be seldom beaten. This applies especially to nitrate and to potash. To use potash alone† can only be described as a gamble. It may be profitable or the reverse—apparently on any kind of land, and particularly on poor clay, it may cause severe loss. A mixture—of almost any description—though short of a complete one, is often true economy.

Increase and Profit.—Very variable; nitrate 5–6 cwt. and profit, say 2s. to 3s. per acre. Sulphate of ammonia may give considerably more.

Dung or Artificial.—Season apart, there is not very much to choose in bulk or profit between the two, given moderate dressings (8 and 10 tons dung).‡ Their use in conjunction is more uncertain in results, but it has a special interest at the present time, and is growing in popularity. Experimental results show that if so used in alternate years returns are more certain, and better on the whole, than from using dung every 4 years and artificials in the interim, and that they compare in the former case pretty well with the use of either separately. Yearly dunging of 15 and 16 loads seems unprofitable. Aftermath and labour are not included in this survey, but the latter speaks for itself.

Slag.—Dung plus slag is a combination well worth trying in these difficult times. Experiments with this combination have given very good results, and practical men have also told the writer of its value, as shown on ordinary meadow land, where also the alternate use of each is found useful in practice.

* University College, Reading, Bulletin No. 15. Manuring of Grass Land in Oxfordshire. *Newcastle Daily Chronicle*, Report by Gilchrist, 16th September and 9th October, 1915.

† Used alone potash has frequently reduced the yield (Wiltshire, Worcester, Cockle Park) and also with seeds hay. Loss, 16s. per acre at Cockle Park (Palace Leas). It has even done so used in combination.

‡ For dung see J. Porter's report on farms in Lancashire, etc. (*Notts. Agric. Society's Journal*), and various.

From very numerous enquiries made he finds that on such land 5 or 6 cwt. gives a good hay crop at first, but considerably less for subsequent dressings, and that frequently the second year is best on strong land; but the inveterate neglect of the use of potash, and even of dung, seems partly to account for this disappointment, as well as the very infrequent trial of $\frac{1}{2}$ -ton doses (which are preferred where they are practised), since second and further dressings have undoubtedly been found very profitable at times in practice.

Attention is called to a point which is said to be of considerable practical importance, but often neglected, viz., to sow in dry weather, and so avoid uneven distribution through the ground owing to the small lumps caused by rain.

Time of Application.—It is now recognised that February or March sowings often give good returns on light land, at any rate of aftermath, but on heavy land results are likely to be better the second year. It is not perhaps generally known that even August applications, in a wet season, have been found profitable for autumn grazing on slag land. It has been described as "thoroughly sound" practice where tried (Gospel Oak Training Farm, Wiltshire). Pretty good hay results have been obtained, it may be stated here, from March and April sowing of kainit (Wiltshire County Council Reports, Midland College Reports) (see also "Seeds Hay"), and often fair crops from April sowing of superphosphate, though this is not advised. Extended doses of 5 cwt. have done rather better than the equivalent in 10-cwt. doses at Sevington and in Suffolk, and elsewhere sometimes, as regards hay.

Best Results Recorded.—The following table gives these over a series of years, leaving out of account the sensational profits recorded at Saxmundham and Kineton, as has been done under the heading "Increase and Profit."

	Locality.	No. of Years.	Increase over un-manured.	Profit per Acre.
			<i>Cwt.</i>	<i>s. d.</i>
Phosphate and Potash ..	Cransley	8	16	32 0
Complete	Salop ..	12	16 $\frac{1}{2}$	18 4
Nitrogen and Potash ..	Staffs. ..	—	11	9 0
Nitrogen and Phosphate ..	Leeds ..	11-12	—	8 11
Nitrogen and Phosphate ..	Salop ..	12	15	18 6
Nitrogen only	Leeds ..	8	—	7 0

Economy of Small Dressings.—A notable feature in using artificials is the economy of small doses rather than large ones. This is well seen in a complete dressing, and is very noticeable in the Irish experiments, where 2 cwt. of any manure is not exceeded, and only slightly exceeded in the Wiltshire and Leeds trials, where good results have been obtained. It is specially noticeable with superphosphate, where excess, it seems, may give no result beyond waste, or, at any rate for outlay, bring in very little. In Northamptonshire on a poor clay the increased profit on 5 cwt. over 3 cwt. was only 8*d.* per acre in a total profit of 13*s.* 8*d.* (First County Report), and it is to be feared that in practice much manure has been wasted from this cause.

Lime (Lime and Superphosphate).—Liming very seldom pays directly. Even with superphosphate it is a somewhat doubtful investment, because slag may pay better. It has been clearly proved, however, that ground lime and superphosphate may do as well as or better than slag in live weight increase,* but here again slag *pays* better on slag soils, even light ones (Sevington). It is worth noting, however, that there may be more profit from lime and superphosphate than from slag where hay is concerned. At Cransley, over 8 years, the profit from slag was 17*s.* 2*d.* per acre yearly, while lime + superphosphate gave 32*s.* 8*d.* (9*s.* and 16*s.*, with hay at 3 *s.* per ton).† At the same time the profits on live weight were rather higher from slag, so great is the difference sometimes between the returns from hay and grazing, and so considerable the extra cost of the lime and superphosphate (43*s.* 6*d.* per acre in 8 years) over that of slag; but generally lime and superphosphate may be said to succeed where slag succeeds.

Lime and Slag‡ is a speculation, and may give adverse financial results, as it has seriously reduced both hay and live weight on light (Sevington) land compared with slag alone, and though better for hay on heavy land, and superior to lime alone, it does not appear to pay.

* Superphosphate and ground lime were notably better than slag at Cransley, and superior to some extent at Saxmundham, but at Cockle Park and Sevington were on the whole inferior to slag in hay yield, whereas they were there distinctly superior to slag on the whole, in live weight increase, where 5 cwt. of slag was used, and nearly equal with 10 cwt. Clearly, therefore, as regards yield, they can hold their own with slag on either light or heavy soil, and for either purpose.

† At Sevington and Cockle Park, better suited to slag, slag paid 7*s.* and 8*s.* 4*d.* better, respectively, on a nine years' average, of hay. Cost of lime 20*s.* (at Saxmundham 28*s.*) per ton; 10 cwt. in every case.

‡ Cockle Park (see guide) and Cransley; see also "Lime and its Uses," A-mitron College Bulletin No. 12, 1915.

With seeds it has been found no improvement on lime. A good deal of caution seems desirable in adding lime to phosphates and potash, in view of the expense involved and uncertain action, but the effect of the threefold combination at Hook, and especially at Rothamsted,* light and heavy soils respectively, shows how profitable it *may* be. The Oxfordshire experiments, however, on some of the heaviest clays, indicate that even where there appears to be enough carbonate in the soil, liming may still be useful in cheaply setting free available potash, which is sometimes very deficient on soils which seem to be capable of improvement in this way, and it is noteworthy that potash has more effect with superphosphate than with slag at Cockle Park. The use of lime with phosphates on some heavy soils would seem to be the safest investment of any. They are in need of both; but slag and basic superphosphate used alone do not always shine here, though experience on the stiffer types of Cornbrash and Oolite—where lime is often insufficient, though not notoriously so—shows that slag is useful here, whereas the lighter types of the same soils, which contain much lime, do well with superphosphate. It would seem, therefore, that these phosphates should have a better chance when fortified with lime on the worst soils, and the experiment is worth further trials and should not be confined to the North. One other feature of lime is worth notice. It generally improves the quality of the herbage, and its effect is distinctly less seen in meat than in hay. This is seen when ground lime is added to superphosphate at Cransley, Cockle Park and Sevington, and generally when slag followed lime. Slag itself varies in this respect, and is excellent for both purposes, and financially it always seems to be the better manure for grazing purposes, even though superphosphate and lime may be the more paying to use for hay. Phosphatic manures without nitrogen seem indeed to show some distinct tendency this way (live weight) as compared to their effect when nitrogenous manure is used along with them, when the tendency is more towards hay (which is always more profitable, even at 30s.), but here, too, phosphates used alone paid better. These considerations have some bearing on the different treatment of pasture and meadow land.

* A very remarkable increase in leguminous plants was found at Rothamsted when lime and chalk, or both, were applied where potash was used with nitrogen and phosphate, but almost nil when potash was withheld. The weight of hay was also increased by up to 22½ cwt. Somewhat similar results were achieved in the Northumberland experiments.

Basic Superphosphate.—Few experiments have yet been recorded, but in the Oxfordshire and in the Buckinghamshire trials* it was tested against slag, and in a few cases in Buckinghamshire against superphosphate. The Buckinghamshire experiments were very extensive, and covered various kinds of soil, while the nine Oxfordshire trials, except two on sand, were mostly on the clays of the Lias, Gault and Oxford strata, which were mostly deficient in lime and responsive to slag, of very varying type, but inferior generally. Results clearly showed basic superphosphate to be almost uniformly useful where lime was deficient (as it very generally was, notably in Buckinghamshire) and sometimes where it was sufficient. Slag behaved very similarly in the Oxford trials, as a rule, but was in Buckinghamshire almost invariably superior to basic superphosphate where lime was deficient, sometimes to a marked extent. At Wing and Mentmore, however, on gravel and chalk respectively, exceedingly deficient in lime, basic superphosphate was distinctly superior.

As compared with superphosphate in the few tests made, its superiority in lime was not marked at weak-lime centres, and in a few cases it even seemed inferior to superphosphate. It was also uncertain in soils containing plenty of lime, being both good and indifferent.

It may be said that where lime is weak basic superphosphate is useful, and yields increases up to 13 cwt. (Oxon.). The average in Buckinghamshire over 4 or 5 years at 10 centres was $5\frac{1}{2}$ cwt., against 7 cwt. for slag, and $4\frac{1}{2}$ cwt. at 7 centres over 3 years in Oxfordshire. The manure was always used unmixed. On gravel its action was found rather quicker than that of kainit and still more than that of slag. It seems probable that better results would have been obtained by the addition of lime at some of the weak centres.

(2) MIXED SEEDS MAY.†

It is pretty clear from a study of the extensive Scotch and English trials that considerable profits over all kinds of soil are generally shown—without considering aftermath or quality—from artificials, losses being unusual. A complete manure gives the biggest crop, and if not invariably the most directly paying, it comes first for general excellence.

* Bulletins Nos. 13 and 15, Reading University.

† See Glasgow and West Scotland Agricultural College Bulletins Nos. 27 and 39, Edinburgh and East Scotland Agricultural College Bulletin No. 13, Lancs. County Council Report, Midland Agricultural College Report, Leeds University Report.

The Amount of Nitrogen to use is undoubtedly the main consideration as regards bulk of hay, and potash and phosphates as regards clover, and a proper balance of the two is everywhere shown to be the desideratum when quality is not sacrificed to bulk. Excess of nitrogen (2 cwt. of nitrate, or sometimes $1\frac{1}{2}$ cwt.) is widely condemned as undoubtedly depressing and even exterminating clover, but heavy soil stands more than does light, and in a one-year ley a market for coarse hay may overrule consideration of quality. A nitrogenous manure generally pays well (£1 or so) in mixed seeds, and a crop of 3 tons is common. There is little to choose between nitrate and sulphate of ammonia, in spite of acidity in the latter, but it is well worth while mixing the two, as more can be applied without injuring quality, and the result of mixing may give up to 3 cwt. extra hay, regardless of season (Middleton).

Potash and Phosphates used together are, as a rule, only striking as regards quality, though certain of the Western Counties trials* show that, especially on light soils, they may pay better, and even give more hay than where nitrogen is used, and the latter should not be rashly employed. It should be noted that they have proved very useful in seed-growing, giving 1-2 cwt. per acre extra in Scotland.

Potash alone is a little uncertain, but undoubtedly useful, and nitrate and potash form a reliable mixture on many soils. Superphosphate alone sometimes pays best of all, but a combination is usually best. Lime seems to give inconclusive results.

Time of Application.—It has been fairly clearly shown that winter or spring dressing as regards potash makes little or no difference to the hay, but that aftermath is more benefited by the former.

Amount of Manure.— $\frac{1}{2}$ -1 cwt. sulphate of potash (this is enough to show a good profit), 2-3 cwt. superphosphate.

QUALITY.

The great value of artificials in relation to quality is being increasingly realised, and where no profit is shown in bulk of hay improved quality, fertility and aftermath may easily represent a not unprofitable outlay. Minor results have been turned into profits on poor land where the hay has been

* Bristol Province Report, 1914. Somerset C. C. Report, 1915.

judged by feeding tests, and improved to the extent of 10s.* per acre with slag, and even more (17s.) when potash is included. Practical farmers have allowed that aftermaths after treatment with various artificial dressings were worth 10s. and 15s. per acre over unmanured†, and the increase at a minimum estimate for the use of superphosphate on poor clay‡ has been put at the rate of 23s. per acre from an outlay of only 10s. 3d.

Much has been said of late years of the deteriorating effect of nitrogen on the herbage, even in meadows, owing to its action in reducing leguminous plants. This, however, seems to depend much on soil, though it occurs on both light and heavy land. From many quarters stress is laid upon the need of using nitrogen with considerable care, and even in meadows nitrogen may easily be wasted where clovers abound, because these do not then appear to perform their economical work, which should always be the goal aimed at where the nature of the herbage permits. Moreover, it does not always pay (it only paid in a few cases in the Oxford trials). The complaint is also made against dung, but the writer, with others, has not found it so in practice, and has seldom noticed any ill effects from this cause in artificials, when phosphates were included in the mixture.

Without any doubt phosphates are the key to success where quality is concerned, and are admirable, even when used alone. Undoubtedly, however, the trouble referred to exists (see also "Mixed Seeds Hay"); even complete manures may show it sometimes, and white clover may be considerably reduced thereby, while nitrogen used with potash on heavy land may be distinctly mischievous (an annual loss of 25s.).§ This failing, however, seems to apply more to continuous dressings|| and it may be reduced by mixing nitrogenous manures with phosphates. Potash is certainly less satisfactory and less certain than phosphate, but the combination is invariably excellent, and seems specially good at improving bottom herbage. Very generally this excellent combination gives the largest proportion of leguminous plants, but fortunately phosphates alone are sometimes all-sufficient, and have taken the first place on

* Cockle Park Guide.

† Harper Adams College, Joint Report, 1910.

‡ Northamptonshire County Council Report, 1915.

§ Cockle Park, Oxfordshire, Gloucestershire, Wiltshire, Buckinghamshire, etc.

|| The Oxford trials show fairly clearly this depressing effect of nitrogen (except in the complete mixture) in the third year, but not before this, and then only slightly. The climax is not reached at Rothamsted until 30 years.

light and heavy soil in this respect in Gloucestershire* and at Cockle Park (Tree) respectively. It is important to notice, however, that a nitrogenous manure may do as well in clovers on some land (especially at Kineton) if it is tempered with phosphates, and still more with phosphates and potash. This makes a very great difference, and represents no less than 10s. per ton in the quality even at Cockle Park (Palace). Recent slagging should thus act as some-corrective when nitrate of soda is applied alone for hay, and is one point in favour of the more frequent dressings of slag now advocated.

The warnings against nitrogenous manures apply more particularly to pastures, and the loss in soil nitrogen is admittedly far more in them than it is in the case of hay, just as the increase from potash and phosphate is very much greater than in hay (Cockle Park and Broomhaugh). Again, quality, according to the Cockle Park feeding trials, 1905-8, seems rather more a question of a high percentage of albuminoids than entirely one of leguminous plants, and in this respect a complete manuring (and very notably dung and slag) can be as good as a phosphatic, if not better, judging by the analyses of herbage given in 1907-8.

Still, judged by continued feeding tests, phosphates, and especially phosphates and potash, for some reason,† give a hay of higher feeding value than does a manure containing artificial nitrogen, although the latter may also contain slag.

It seems wise, therefore, to be strictly moderate in the use of nitrogen, and practical opinion endorses the value of slagged hay, and is not over fond of the "nitred" article. This, however, means excess of nitrogen, which we have seen is likely to give unsatisfactory results. The deteriorating effect so clearly seen at Rothamsted was no doubt largely due to its long continuance, and to the immense quantities used. These are never wise, and the question turns on the relative value of quantity and quality when selling or feeding hay, provided aftermath is not much injured. The safe amount will depend a good deal on soil, and as much as 2 cwt. was found the best quantity to use after various tests by Leeds University,‡ in a complete dressing, even on light land, over many years and at various centres, quality not being mentioned. Undoubtedly the matter is one of much economic importance at

* Royal Agricultural College Scientific Bulletin (latest).

† Something of the kind was also experienced in the Scotch pasture experiments already mentioned, showing the superlative feeding value obtained by the use of phosphates.

‡ 1914 Guide.

the present time, and the great loss of soil nitrogen at Cockle Park (Palace), due to the use of nitrogenous manure on pastures is one of great significance.

The whole question is, however, one of degree, as well as of kind of manure, for any kind, used alone, may, it seems, eventually, sometimes quickly, be injurious. Slag is not exempt, as the scathing comments sometimes made by farmers seem to indicate. Potash, for example, when used alone, may have actually injurious effects in encouraging coarse and unsatisfactory herbage, and when combined with nitrate it may be little better (and it has been known to reduce yield), though quite good at times, but almost any other combination of manures generally exercises, in some way or other, an increased power for good which farmers are still far from properly appreciating. Bad qualities are cancelled—when even nitrogenous manures are mixed together—and good ones revealed or improved on, and it may be said with some confidence that if a mineral manure does well when used alone its good qualities will persist in a combination. Where dung is introduced as well, however, in combination with artificials, the results are more uncertain, it would seem, and the marked inferiority in the feeding value of hay at Cockle Park when dung and complete artificials are used, together or alternated, over their separate use, cannot pass unnoticed. It does not, however, materially lessen the quantity. The above remarks on the value of mixing artificials apply even more to quantity, and a good axiom is—"when in doubt mix," or use alternately, more especially nitrate of soda and sulphate of ammonia. The practical aspect of the question is seen well in the residual value of the artificial manures as shown by grazing. Any phosphate or complete manure plot is invariably very popular with cattle (pigs are very keen in this way on phosphates, it is said) potash apparently less so, owing to rougher herbage, and the writer's own observations in Buckinghamshire and also to some extent in Wiltshire, over 2 or 3 years, show little or no annual inferiority in clover or quality, which continued good, where nitrogenous manures were not used alone, though these signs of inferiority were apparent throughout this period where nitrate only was used, cattle still preferring, till late autumn, any others but the dunged plot. The kainit plot also maintained its poor appearance.

This after only two or three manurings, and after many years since the last manures were applied, shows that fairly

permanent results may be hoped for in a few years, and in a very few months much improvement may set in, though the good effects of potash may soon decline. It should be looked on as a capital investment.

Effect of Dung.—With dung we are on surer ground. Here the Buckinghamshire and Cockle Park trials show on heavy soil a good proportion of leguminous plants, and in Oxfordshire over 3 years little or no diminution over the unmanured (except somewhat on sand), while the Cirencester trials over many years show dung to be as good in this way as a complete dressing on light soil. The last centre also shows the striking effects of other organic manures, especially guano, as herbage improvers, though inferior to phosphate, etc. Even Cockle Park trials with 8 tons give dunged hay a feeding value second only to slag, and show 7s. per ton over the 50s. standard. It seems likely that extravagant use is mainly responsible for any bad results. These were worse with 15 than with 10 tons over 9 years in Lancashire and 10 has been found excessive at Leeds. (See under paragraph "Dung or Artificials," p. 611). The addition of slag appears to be an excellent corrective, and well worth trying. There is evidence* over many years that dung strikingly encourages the best grasses, although it increases weeds and brome grass notably, but it seems that when alternated with artificials, or only used every second year, that it is clearly better in this respect, and in showing fewer inferior grasses, and that it is always strongly antagonistic to bent grass.

Effect of Artificials on Weeds and Grasses.—To the credit of nitrogenous manures, it must be said that they keep down weeds—better sometimes than phosphates, etc. They are decidedly best in this when not used alone, a complete dressing having been clearly shown to be the best in extended trials at Leeds, Cirencester and Rothamsted, all of which showed sulphate of ammonia to be specially useful, weeds, and especially buttercups, being at once reduced (Gloucester), whereas nitrate sometimes encourages them. As regards grasses these two manures always have great influence; but it seems to depend very much on soil as to which kind to use, and (unlike their action on weeds) whether it is wise to use them alone, as their effect for good or ill, like their influence on legumes, evidently depends largely on how they are used, as their comparative merits certainly do. Either may encourage good or

* Cirencester Bulletin and Leeds University Reports (various).

bad grasses, but sulphate of ammonia has very great influence in the last direction (Leeds). A great feature of artificials generally is simplification of herbage, and properly used their power for good is great and could add enormously to the welfare of this country.

Notes as to References.—Some of the experiments on which this article is based are not covered in the references here given, but particulars of these, as also of many of the experiments to which reference is made, will be found in an article by the writer in this *Journal* for February, 1914, where they are tabulated in considerable detail.

Particular attention is directed to the Cockle Park Guide, the Board's *Journal* Supplement No. 5, the Reading University Bulletin (with maps and illustrations) and the Cirencester Bulletin, which contain much valuable information on this wide subject.

THE COST OF STEAM THRESHING.

IN view of the general rise in threshing charges throughout the country it may be useful to publish figures* and facts relating to the costs of threshing contractors and the conditions under which they work. These may afford some guidance as to a reasonable standard of charges during the present season.

It may be explained that the customs of the threshing trade vary considerably in different localities both as regards the basis of charges and the services rendered by the contractor. The most general practice of charging for threshing is by the day, with a minimum of half a day, or a minimum charge for setting the tackle. In many districts, however, the work is done on a piece-work basis, a method that is not always satisfactory, as the contractor usually pays his men at daily or weekly rates, whilst unexpected variations in the yield of crops may render the threshing charge either excessive to the farmer or unremunerative to the contractor. In some places the men have refused to do piece work. Threshing at piece-work rates is usually carried out at so much per quarter, but the following exceptional rates may be quoted :—

- (a) In East Anglia threshing is paid for by the "coomb" (4 bush.) or "score" (20 coombs or 10 qr.) ;

* These figures have been obtained from members of the threshing trade. They have been carefully scrutinised and are believed to be in all cases reliable.

(b) In Cumberland the local rate is per " bag " ($1\frac{1}{2}$ Carlisle bush. = 5 imperial bush.).

In a few districts, especially in the Western Counties, hourly rates obtain, usually with a minimum charge for setting the tackle. The contractor as a rule objects to this method as the men will not accept payment at time rates and insist on payment for any idle time between meals. The farmer, on the other hand, objects to paying for more than the net time actually worked by the machinery.

The number of men required depends to a certain extent on the size of the threshing box, but this number also varies according to local conditions. There is also a good deal of variation in the number of men, besides the driver and feeder, who travel round with threshing sets, and consequently in the number of men whom the farmer must supply. The threshing gangs which were organised during the War by Agricultural Executive Committees were purely war-time expedients, and will largely disappear this season.

There is considerable diversity in the method of paying the driver and feeder. In the past the farmer has sometimes paid the whole of these wages, but this practice appears to be dying out. In many cases, however, the farmer still pays part of these men's wages, whilst a more general practice is for the farmer to pay victual money or supply actual food. It is evident, therefore, that the local conditions must always be taken into account when considering the cost of threshing to the farmer in any particular district. Where rates are low it may be found that the farmer is bearing a large part of the men's wages.

The following statements refer to the costs of threshing proprietors: no allowance is made for indirect remuneration of labour borne by farmers. In practically all cases farmers have to supply coal and water, the cost of which must be added to the rates shown in order to arrive at the total cost to the farmer.

Table I. (a).—The table on p. 623, which refers to a South-Eastern district of England, shows the cost of steam threshing materials and labour for the years 1914 to 1919, and, with a few exceptions, the percentage increase each year. The increase of 1919 prices over those obtaining in 1914 varies from 75 per cent. in the case of straw lines to 200 per cent. in the case of waterproof covers; the average increase is 147 per cent.

Item.	1914.		1915.		Increase on 1914.		1916.		Increase on 1915.		1917.		Increase on 1916.		1918.		Increase on 1917.		1919.		Increase on 1918.	
	£	s. d.	£	s. d.	Per Cent.	£	s. d.	Per Cent.	£	s. d.	Per Cent.	£	s. d.	Per Cent.	£	s. d.	Per Cent.	£	s. d.	Per Cent.	£	s. d.
Driving belts ..	5	6	0	5	6	0	6	15	0	27	6	15	0	27	10	3	0	91	12	15	0	140
Small belting ..	1	0	0	1	3	0	1	9	4	46	1	13	4	66½	1	16	8	83	2	11	8	158
Waterproof covers per yd.	0	1	10	0	2	9	0	3	0	64	0	3	6	91	0	4	8	155	0	5	6	200
Straw lines ..	0	1	0	0	1	3	0	1	3	25	0	1	3	25	0	1	6	50	0	1	9	75
Oil ..	0	1	1	0	1	2	0	1	8½	58	0	2	0½	89	0	3	2	192	0	2	8	146
Tallow ..	1	17	0	2	0	0	2	15	0	49	3	12	0	95	3	12	0	95	4	19	0	168
Waste ..	0	0	2	0	0	2	0	0	2	—	0	0	3	50	0	0	5½	162	0	0	5½	162
Iron and Steel Parts and Renewals	9	10	0	17	0	0	19	10	0	105	19	10	0	105	20	0	0	110	26	0	0	174
Mechanics for Repairs	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	60	—	—	—	—	100
Drivers' wages	0	0	6½	0	0	8	0	0	10	54	0	0	11	69	0	1	0	85½	0	1	4	146
Feeders' wages	6d.	per hour.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	£2 per week, 6s. day bonus. 35s. per week, 5s. day bonus.	—	—	33½

Table I. (b).—The following figures show the average capital outlay and the receipts and expenditure for one year's working at present prices :—

Capital Outlay.

The present cost of a new 8 h.p. engine and 5 ft. threshing machine is £1,680, whilst the pre-war cost was £700. The average of these amounts, viz., £1,190, may be taken as a fair valuation of an average set at present. £110 will be required as working capital, giving a total capital outlay per set of £1,300.

One Year's Working Expenses

Take the threshing season as extending from 1st August to 1st April, i.e., 34 weeks, and the number of days worked as 120.*

<i>Wages :</i>	£	s.	d.
Driver, 34 weeks at £2 standing wage ..	68	0	0
„ bonus 6s. per day when threshing ..	36	0	0
Feeder, 34 weeks at £1 15s. standing wage ..	59	10	0
„ bonus 5s. per day when threshing ..	30	0	0
Casual labour moving tackle from farm to farm at 5s. per week	8	10	0
	<hr/>		
	£202	0	0

Insurance :

Men's Health Insurance and Employer's Liability Insurance	7	8	0
Fire Insurance and third party risk against accidents on the road	8	0	0

Materials :

Oil, grease, waste, straw lines and sundries at 4s. 6d. per day	27	0	0
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<i>Repairs :</i> To engines and machine, driving belts, waterproof covers, etc.	90	0	0
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<i>Depreciation :</i> On engine and machine	75	0	0
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Total Working Expenses	£409	8	0
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120 days' work at £4 5s., which is the rate fixed for this season = £510, leaving about £100 profit,

out of which supervisory, office, etc., expenses, have to be paid. This, it is estimated, will leave a return of barely 6 per cent. on the capital invested (£1,300), and the machine owner has to work 96 days before recouping his expenses for the season.

Table II.—The following figures show the receipts and expenditure for a threshing set in one of the principal corn growing districts of the Eastern Counties. It is assumed that

* This is perhaps rather a high average. In the case of a firm owning several sets of tackle it is not unusual for some of them to finish the season's work before Christmas.

the set works 20 weeks of 4 days each on the average, or 80 days in all :—

EXPENDITURE.			RECEIPTS.		
	£	s. d.		£	s. d.
Labour : Driver £63			80 days threshing at		
and Feeder £53 ..	116	0 0	£4 per day (the rate		
Supervision and over-			proposed for this		
head charges ..	20	0 0	district)	320	0 0
Materials : Oil and			Less discount and al-		
Waste £12 ; Fuel,			lowance for bad		
etc., used on owner's			debts, etc.	20	0 0
premises £10 ; Covers					
£10 ; Belting £10 ;					
Jointing and Packing					
£2	44	0 0			
Insurance : .. Health					
13s. 4d. ; Workmen's					
Compensation					
£5 10s. ; Fire, etc					
£5	11	3 4			
Annual Repairs :					
Labour £20 ;					
Material £15 5s. 0d.	35	5 0			
Depreciation on set*	50	0 0			
Total ..	£276	8 4			
			Profit	£300	0 0
				£23	11 8

If 100 days were worked the extra cost would be £56 10s., and the extra receipts £75, giving a total profit of £40 1s. 8d. for the set. This probably represents about 3 per cent. upon capital.

In a district in the South Midland Counties wages and materials (*i.e.*, covers, belts, oil, etc.) have increased over 100 per cent. since 1914, whilst annual repairs, which were neglected during the War, will now cost, it is stated, about 150 per cent. more than in 1914.

In conclusion it may be pointed out that in many instances the charges for threshing before the War were unduly low, especially in the case of small owner-drivers who usually purchased their tackle with borrowed capital. It is claimed that the charge of 30s. per day which was made in 1914 in many districts was not remunerative to the threshing proprietor. In some cases an even lower rate was charged. It will be seen that the threshing contractors' costs for labour and materials have on the average risen between 100 per cent. and 150 per cent., and in view of this increase an advance on the 1914 threshing rates, varying from 100 per cent. to 150 per cent. according to local conditions, may, on the whole, be considered fair and reasonable for this season ; but in those districts where unduly low rates were in operation before the War, it is possible that a larger increase may be justified.

* For the value of a threshing set, see Table 1 (b).

"DEEP TILLAGE" or "Subsoiling" aims at stirring the subsoil without at the same time mixing it with the surface soil.

Its object is to open the subsoil, thus affording freer access of air and more play to the roots of the growing plant. The operation also helps the passage of water and so makes the soil drier and warmer. It is especially useful in cases of "pan," however caused, and particularly in the case of clay pan, which is likely to occur where heavy land has been ploughed to the same depth year after year. As a general rule, and especially in the latter case, it is not of much use without a regular system of drainage, though sometimes with a porous subsoil and other favourable conditions the natural drainage will suffice.

Early last spring a visit was paid by an officer of the Board to some land in the neighbourhood of Southchurch, near Southend, Essex, where some very practical object lessons in the value of deep tillage on land of the Brick Earth formation were inspected. It was possible to see, side by side, a field that had been subsoiled and a field that had not, both planted with wheat. The subsoiled land, worked on the flat, was firm and dry. The other was worked on the narrow stetch—water was lying in the furrows and the stetch was a quagmire 5 or 6 in. deep. Beneath the quagmire, however, after sinking to the boot-tops, one found a very solid foothold. The subsoiled land, on the contrary, was firm to the tread and uniformly moist, but not too wet, to a depth of about 18 in. Here the subsoil was a kind of sandy clay, owing its hardness, apparently, to lack of organic matter. The fact that from a subsoiled field on the farm in question over 19 tons of Great Scot potatoes per acre were cropped in 1918 is, perhaps, sufficient testimony to the soundness of the procedure in this case.

The gentleman at whose suggestion the visit was paid had, before his retirement, farmed extensively on Foulness Island. There the soil is a deep alluvium, resting on a porous subsoil. The land is flat and only a few feet above sea level. Ploughed to the ordinary depth of 6 in. or so the top soil becomes waterlogged in winter, and in wet weather actually submerged. By means of deep steam tillage the hard layer beneath the surface had been broken and a large farm transformed from an almost derelict condition to a state of the highest productiveness.

Subsoiling is best done in autumn, either prior to a root crop, or while the land is being bare-fallowed. The soil,

especially if heavy clay, should be as dry as possible ; if too wet there is a risk of puddling. The subsoiling should be done across the direction of the drains, to ensure more active drainage.

The best and cheapest method is to use a subsoil plough with steam tackle. The implement used on the Southchurch land above referred to, however, was simply a plough body without the mould board. It was drawn by two horses in the wake of the ordinary plough, also drawn by two horses, and the combined operations reached a depth of about 18 in. The expense, therefore, amounts to an extra ploughing and would usually be incurred once in a rotation.

It is impossible, especially in the absence of much experimental work, to lay down any general rules. On land of the character referred to in the instances given, deep tillage has proved its value ; and wherever drained land readily becomes waterlogged farmers might be advised to try the experiment on a small scale at first and regulate future action by results. Where there is clay mixed with sand or gravel, or where the subsoil is chalky, and the state of the upper surface in wet weather shows that the water is not getting away as it should, then drainage should be looked to and the question of deep tillage considered.

VERY extensive deposits of phosphate rock have recently been discovered at El Beroudj in the French Zone of Morocco.

**Phosphate Rock in
Morocco.**

These deposits, which at the centre are about 125 kilometres (78 miles) from the port of Casablanca, are said to extend as far as Oued Zem and to cover a very considerable area ; the future Casablanca—Marrakesh railway will pass within a few kilometres of the centre. Preliminary investigations made at different points suggest that the deposits may amount to more than 1,000,000,000 tons, and the samples which have been analysed give results of about 65 per cent.

The concession for working these deposits will be put up for public tender in a few months' time ; the actual date on which tenders will be called for will be announced three or four months in advance. Meanwhile the " cahier des charges " and the conditions under which interested parties may carry out investigations have been published, and the works already undertaken by the Service of Mines are open to inspection. The concession will be granted to the company which offers the highest amount per ton exported from the Protectorate.

The Protectorate Government attach the greatest importance to the exploiting of these deposits, and are anxious to attract the interest of powerful companies; it is considered that a capital of 100,000,000 francs. (approximately £4,000,000) would be necessary properly to work the deposits. The company which obtains the concession will be called upon to contribute to the cost of constructing and equipping the necessary quays at Casablanca: as railways of at least 1 metre gauge will also have to be laid down, it will probably be quite two years before any phosphate rock can be exported.

Further information can be obtained from M. Savry, Chef du Service des Mines, Résidence Générale de la République Française au Maroc, Rabat, Morocco.

A Special Campaign.—With a view to inaugurating an effective rat destruction campaign throughout the country, before the

**Some Suggestions
for Intensive Rat
Destruction.**

winter migration sets in, it is suggested by the Board that a "Rat Week" should be arranged for in the district of every Local Authority. A suitable week would be the period 20th—27th October next. In order to obtain good results it is desirable that Local Authorities and Officers appointed to supervise rat destruction should immediately consider the best procedure. The ravages committed by rats last winter are too well known to need description here. A large amount of corn had to remain in the stack for a very long period owing to the exigencies of the War, and the amount of food consequently available for rats resulted in a heavy breeding stock of rats in many districts. Unless this stock is energetically attacked during the early autumn a repetition of the serious losses of essential foodstuffs is threatened for the coming winter.

Many Local Authorities have realised the need of systematic rat destruction, with the result that they have appointed officers whose duty is to ensure that such destruction is carried out. It is hoped that the following notes may be helpful to those engaged in the task.

In inaugurating a "National Rat Week" the goal aimed at is the simultaneous destruction of rats throughout the whole country by all and every suitable means available. The campaign should recognise the necessity for the *continuous* destruction of rats arriving in ships in our harbours and docks from overseas, and for steps being taken in all ports and docks

to prevent immigrant rats landing *at any time*. This need should steadily be kept in view and acted upon.

Ways and Means.—Those who are supervising rat destruction should now begin to consider ways and means. They should prepare the campaign in their district, and any arrangements contemplated should, as far as possible, be made in co-operation with those who are engaged on similar work in districts or counties adjacent to their own.

It should also be borne in mind that the Military Authorities throughout the country are undertaking intensive rat destruction in camps, barracks and other places in military occupation. They are most anxious to work in co-operation with the inhabitants of civil areas surrounding such places, and should have the wholehearted support of the Local Authorities of such districts.

Returns as to the normal rat infestation of all parts of the area to be treated should be collected ; the amount of poisons required (where poisons can be used), and of other media for rat destruction, should be computed, and arrangements made in good time for the requisite supplies to be obtained.

It would be of great assistance if owners or occupiers of premises could be informed as to the desirability of immediately undertaking the rat-proofing of buildings used as food stores.

Village Committees.—In each village a small committee might usefully be formed to undertake voluntarily the laying of baits, and to encourage trapping, ferreting, the use of carbon bisulphide, etc., during the rat week. It would assist if meetings could be convened at which the Local Authorities' Rat Officer could unfold his plan of action, and obtain the support of local residents in the work. At these meetings the uses of the various media to be employed and the method of their application should be explained.

Prizes for Rat Destruction.—In places where rat clubs do not exist an effort might be made to institute a scheme by which prizes are offered for the largest number of rats caught within a given area. Land owners, farmers, market gardeners, fruit growers, poultry keepers, millers and others would doubtless be prepared to offer prizes, or contribute to a prize fund. The cost of the media employed should be borne by the owner or occupier of the premises or lands treated, the immediate pecuniary benefit being primarily theirs—the prevention of waste of food at the source of production is of prime importance.

Infested Places.—In urban districts, in addition to infestation caused through defective drains, which it is imperative should be repaired, the refuse dump and the sewage farm are found

to be the chief sources of rat infestation. From October to March food in the open is scarce for rats and at such places as those mentioned large numbers can be destroyed. Slaughter houses, cattle and other produce markets are frequently badly infested, and these should be thoroughly attended to. Warehouses at the docks frequently require attention; and railways carry from the seaboard to the inland towns rats which, with their offspring, subsequently infest the food stores throughout the country.

Repeated Action.—Although such systematic action will materially reduce the existing rat population, it is advisable to repeat the "rat-week" at least twice before next spring, say in December and at the end of February before the spring migration and breeding season starts.

The rat population might thus well be reduced to quite 40 per cent. of that of a normal winter, but if such a result is to be obtained in the fight against the rodents (and in destroying the rats we must not spare the mice) universal effort must be made throughout the Kingdom. Premises should be secured against their entry, and efforts to prevent them causing loss by stealing goods and destroying property should never be relaxed.

The Rats Branch of the Board will give information if desired concerning various preparations used for the destruction of rodents.*

THE present situation with regard to feeding-stuff supplies for poultry leaves much to be desired. While the majority of

**Notes on Poultry
Feeding:**

*From the Harper
Adams Agricultural
College, Newport,
Salop.*

feeding stuffs are now on the market again supplies generally are short, which means that, for the person needing only small consignments, they are often unobtainable. Prices, too, are high, though egg prices have shown a tendency throughout the season to remain at a figure that may be expected to allow a reasonable margin of profit in well-managed flocks.

The situation has not been eased by the drought which until quite recently has been fairly universal throughout the country in its intensity and continuance, and has contributed towards a shortage of green fodder that at this season of the year can usually be counted upon to supplement the hand feeding. Early easing of the feeding stuff supply as regards the grain

* See also this *Journal*, May, 1919, pp. 203 and 211.

feed is promised with the exceptionally early harvest, operations being already well advanced in most parts of the country.

Poultry farmers and farmers who keep poultry as a side-line would be well advised, however, not to rely on the possibility of large supplies of tail grain, with the disappointing prospects this year of the spring-sown corn crops. Plans should be laid upon the assumption that the supplies available will be inadequate and of comparatively short duration.

To this end every effort should be made by all owners of poultry stock to make the best possible use of such supplies as they may be able to obtain, and it is noteworthy that the present season of the year offers itself as the most suitable for the culling of flocks kept for egg production. The recent Annual Conference of Poultry Breeders at the College was unanimous for a vigorous culling campaign in this country on the lines of those undertaken by the Poultry Husbandry Department of the United States Department of Agriculture. The intimate relation between culling and the conservation of the food supply is borne out by the figures given for the State of Missouri, in which it is estimated that 80,000 birds were culled without an appreciable deterioration in the egg returns for the State.

The British poultry keeper can be confidently recommended to resort to the culling out of his flocks at the present season, because the curve of egg production shows a maximum decline at this time of the year and the temporary increase of food on stubbles and by threshing will make it possible to bring culled stock into a marketable condition for the table.

With regard to the method of determining whether culling is necessary in any particular flock, facts presented at the above Conference showed conclusively :—

- (a) That birds that had passed their third season of laying rarely leave sufficient profit, over and above the cost of food, to justify their being kept as layers.
- (b) That the question of culling being necessary or urgent should be determined by reference to the egg yield of the particular flock.

The egg output necessary per day per 100 hens just to meet the cost of food is determined from the formula $\frac{x}{y} \times 3$, where x is the price of food per 100 lb. and y the current price of eggs per dozen.

The above formula is based upon the assumed consumption of 4 oz. of food per bird per day, which has been shown in the laying trials to be the average daily consumption per bird.

The formula also assumes that all food has to be purchased, the consumer of home-produced foods being in the fortunate position of producing marketable eggs at a cheaper rate.

To aid the reader of these notes in the application of this formula to local conditions the following present prices of feeding stuffs in common use are given:—

							<i>Per 100 lb.</i>	
							<i>s.</i>	<i>d.</i>
Bran	..	..	..	..	..	..	13	7
Fish Meal	..	..	..	..	..	..	22	9
Clover Meal	..	..	..	..	..	..	10	8
Compound Meal (chiefly Palm Kernel)	..	..	..	..	..	..	16	8
Sharps	..	..	..	..	..	..	15	2
Maize Germ Meal	..	..	..	..	..	..	22	1
Mixed Poultry Grain	..	..	..	..	..	..	20	0

THE Committee appointed by the President of the Board of Agriculture and Fisheries on 24th January, 1918, to consider all statistical returns relating to the number

**Final Report of the
Departmental
Committee on Live
Stock and Meat
Production.**

of live stock in the United Kingdom and to the home production of meat, have recently issued their final report. The Committee were constituted as follows:—

Sir Henry Rew, K.C.B., *Chairman*; Sir Thomas Middleton, K.B.E., C.B., Professor T. B. Wood, C.B.E.; Mr. R. H. Hooker, Board of Agriculture and Fisheries; Sir Robert Greig, M.C.; Mr. J. M. Ramsay, O.B.E., Board of Agriculture for Scotland; Mr. J. R. Campbell; Mr. J. Hooper, Department of Agriculture and Technical Instruction for Ireland; Mr. G. Udney Yule, C.B.E.; Professor Gonner, C.B.E.; Mr. Anker Simmons, C.B.E., Ministry of Food; Mr. H. W. Macrosty, O.B.E., Board of Trade. Mr. R. Ross, Board of Agriculture and Fisheries, was appointed Secretary. On the 1st July, 1918, Professor Gonner, C.B.E., resigned from the Committee and Mr. J. B. Guild, M.B.E., Ministry of Food, was added to the Committee in his stead.

The work of the Committee fell under two main headings—(a) Estimates of the number of live stock in Great Britain each month and in Ireland every second month, and (b) Forecasts of the number of cattle and sheep which would come forward for slaughter and the quantity of home-produced meat which would become available.

It is stated that the slaughter of cattle and sheep was exceptionally heavy during the closing months of 1917 and the

Committee estimated that the number of cattle slaughtered in the last six months of that year was some 150,000 to 200,000, and of sheep about 800,000 greater than usual. The number of sheep had also already been reduced owing to the very bad lambing season of 1917. The number of pigs at the beginning of 1918 was also much below the normal, the estimated number of breeding sows being much smaller than that recorded in June of any year since sows were first separately distinguished in the Agricultural Returns in 1893. During the early months of 1918, however, the number of cattle and sheep slaughtered was less than usual, and the herd gradually increased, so that on 4th June, 1918, there were only 27,000 fewer cattle in Great Britain than a year earlier. The reduction in the number of sheep had not been made good, and on 4th June, 1918, there were 700,000 fewer sheep and lambs in Great Britain than a year earlier, the reduction being practically equal to the estimated exceptional losses in the lambing season of 1917. The number of pigs had been reduced by 225,000.

A comparison between the Committee's estimates of the number of live stock in Great Britain on 4th June, 1918, made before the Agricultural Returns were available, with the ascertained figures, is as follows :—

					Committee's Estimate.	Agricultural Returns.
Dairy Herd	..	..	..	..	2,980,000	3,030,000
Beef Cattle	..	..	..	..	2,800,000	2,852,000
Calves	..	..	..	..	1,600,000	1,528,000
Total Cattle	..	..	..	..	7,440,000	7,410,000
Breeding Fwes	..	..	..	..	9,250,000	9,501,000
Other Sheep (including Lambs)	..	..	..	..	13,750,000	13,852,000
Total Sheep	..	..	..	..	23,000,000	23,353,000
Breeding Sows	..	..	..	..	290,000	306,000
Other Pigs	..	..	..	..	1,590,000	1,519,000
Total Pigs	..	..	..	..	1,880,000	1,825,000

From June, 1918, to June, 1919, the slaughter of cattle each month was more nearly normal than in the previous twelve months, and the Committee estimated that the number of cattle had been maintained. They were of opinion, however, that the flocks of the country had been much further reduced and that the number of sheep and lambs in Great Britain was about 1,800,000 less than the number shown on 4th June, 1918

in the Agricultural Returns. The Committee estimated that on 4th June, 1919, the number of breeding sows was no greater than a year earlier, but the number of other pigs had increased.

The number of cattle and sheep in Ireland, as in Great Britain, decreased between 1st June, 1917, and 1st June, 1918, but there was a slight increase in the number of pigs during the twelve months. Estimates for 1st June, 1919, are not yet available, but the previous estimates during the year indicate that the present position in Ireland is very similar to that in Great Britain, viz.—that the number of cattle is substantially the same as a year ago, and that the flocks have been reduced. The number of breeding sows seems to have been maintained and the number of other pigs to have increased during the twelve months ended 1st June, 1919.

The Committee estimated the number of cattle which would come forward for slaughter in Great Britain and the weight of beef which would be produced during the twelve months October, 1918—September, 1919, as follows:—

—	Estimated Number of Cattle to be offered for Slaughter.	Estimated Average Dressed Carcass Weight	Estimated Production of Beef.
		<i>Lb.</i>	<i>Tons.</i>
October to December, 1918 ..	600,000	550	147,000
January to March, 1919 ..	520,000	540	125,000
April to June, 1919 ..	480,000	510	109,000
July to September, 1919 ..	600,000	560	150,000
Total	2,200,000	—	531,000

Similar estimates regarding the slaughter of sheep and lambs were made as follows:—

—	Estimated Number of Sheep and Lambs to be offered for Slaughter.	Estimated Average Dressed Carcass Weight.	Estimated Production of Mutton and Lamb.
		<i>Lb.</i>	<i>Tons.</i>
October to December, 1918 ..	2,700,000	50	60,000
January to March, 1919 ..	1,620,000	56	40,000
April to June, 1919 ..	1,980,000	54	48,000
July to September, 1919 ..	2,700,000	43	52,000
Total	9,000,000	—	200,000

Up to the present these estimates have been fully justified, the number of cattle and sheep which have been slaughtered (according to the hide and sheep skin returns) being as follows:—

	No. of Cattle slaughtered.	No. of Sheep and Lambs slaughtered.
October to December, 1918	609,000	2,673,000
January to March, 1919	525,000	1,583,000
April to June, 1919	540,000	1,915,000

The system of monthly (in the case of Ireland two-monthly) returns of the changes in the numbers of live stock in certain districts, which was started in June, 1917, has now been discontinued. It has not always been easy to induce some stock-owners to make these returns, the value of which was not apparent to them, and while they complied with the request of the Boards during the War, their reluctance to continue to do so became in some cases marked. The data collected in this way over a period of two years will afford useful material for estimating seasonal changes in future.

OFFICIAL NOTICES AND CIRCULARS.

N.B.—The Orders which may be mentioned in this section of the JOURNAL may usually be obtained at the price of 1d. each from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, and 28, Abingdon Street, London, S.W. 1; 37, Peter Street, Manchester, and 1, St. Andrew's Crescent, Cardiff.

ARRANGEMENTS have been made whereby flour millers will be in a position to purchase all home-grown wheat of the 1919 harvest offered to them at such prices as will produce for the whole crop an average *Gazette* price of 71s. 11d. per qr. of 480 lb., equivalent to 75s. 6d. per qr. of 504 lb.

Prices of the Wheat Crop of 1919.

While the average price will be 75s. 6d. per qr. of 504 lb. the market will be free, and each sample of wheat will be bought on its merits; if of milling value above the average it will be worth more than 75s. 6d., while samples of inferior quality or out of condition will only be saleable at prices below the average. Every seller of wheat will have to make the best terms he can, as under the ordinary pre-war conditions of a free market, and will not have the right to call upon a miller to buy at 75s. 6d. or any other price.

While it is anticipated that the average price will be at least 75s. 6d. per qr. of 504 lb., equivalent to 71s. 11d. per qr. of 480 lb., *Gazette* prices will be collected as usual, and if at the end of March, 1920, the

average *Gazette* price should prove to be lower than 71s. 11d. per 480 lb. payment will be made, as promised, to the grower of each acre of wheat of four times the difference between 71s. 11d. and the average *Gazette* price of wheat for the seven months September, 1919 to March, 1920.

THE prices guaranteed by the Government of barley, oats, and rye for 1919 are as follows :—

	Barley, 61s. 6d. per qr. of 400 lb.
Prices of the Barley,	Oats, 44s. 1d. per qr. of 312 lb.
Oats and Rye Crops	Rye, 71s. 11d. per qr. of 480 lb.
of 1919.	

So far as can at present be foreseen it is probable that the average prices obtained by growers for barley, oats and rye of the 1919 harvest will exceed the prices guaranteed by the Government, but if the average price should prove to be lower than the guaranteed prices effect will be given to the guarantees by the method adopted in Part I. of the Corn Production Act, 1917. This involves payment to growers of any difference between "average prices" and the above guaranteed prices.

For the purpose of this calculation the following yields per acre are assumed :—Barley 4 qr., oats 5 qr., rye 3½ qr., and payment is made in respect of four-fifths of the acreage of barley and two-thirds of the acreage of oats. Only the acreage of rye which is harvested for grain may be reckoned.

The payment for each acre of corn will thus be calculated on the following basis :—

Barley.—Four times four-fifths of the difference between the average and the guaranteed price.

Oats.—Five times two-thirds of the difference between the average and the guaranteed price.

Rye.—Three and a half times the difference between the average and the guaranteed price.

All payments under the guarantee are subject to the provisions of Clause 1 (b) of the Corn Production Act, 1917, which states "if it appears to the Board that any such land has been negligently cultivated, the Board may either withhold altogether the payments to which the occupier would otherwise have been entitled or may diminish the amount of those payments to such extent as the Board think proper to meet the circumstances of the case."

AN Order (No. 1013), dated 14th August, 1919, has been made by the Food Controller to the effect that :—

	PART I.—RESTRICTION ON USE AND SALE BY WEIGHT.
The Cereals	
(Restriction) Order,	1. <i>Wheat to be used only for Seed or Flour.</i> —
1919.	(a) A person shall not use any wheat except for the purpose of seed, or except in the process

of manufacturing flour.

(b) This clause shall not apply :—

- (i.) to tailings or screenings of wheat which are unfit for use in the manufacture of flour for human food, and which have been certified as such under a certificate in Great Britain of any two members of a panel to be appointed by or under

the authority of the Food Controller for the purposes of this Clause, and in Ireland of any person or persons to be appointed for the purpose by or under the authority of the Food Controller ; or

- (ii.) wheat which has been so damaged as to be unfit for use in the manufacture of flour for human food and which has been certified as such in accordance with the provisions of the preceding Sub-clause.

2. *Use of Wheaten Flour, etc.*—A person shall not use any wheaten flour, rice or rice flour except in the manufacture of articles suitable for human food, or use any article containing any wheaten flour, rice or rice flour except as human food.

3. *Damaging Wheat, etc.*—A person shall not damage or permit to be damaged or treat or permit to be treated, any wheat, wheaten flour, rice or rice flour or any article containing wheat, wheaten flour, rice or rice flour so as to render the same less fit for the purposes of seed or the manufacture of flour or articles suitable for human food, or waste or permit to be wasted any such grain, flour or article.

4. *Samples.*—Any person authorised by the Food Controller may take samples of any wheat, wheaten flour, rice or rice flour or other article which he has reason to suspect is being used, damaged or treated or is intended to be used, damaged or treated in contravention of this Order.

5. *Restriction on Sales.*—A person shall not sell or offer to sell any wheat or any tailings or screenings of wheat (other than wheat, tailings or screenings certified under the provisions of Clause 1 of this Order as unfit for use in the manufacture of flour for human food) to any person other than—

- (i.) a miller buying for the purposes of the manufacture of flour ; or
- (ii.) a person who in the ordinary way of business deals in wheat for the purpose of his livelihood ; or
- (iii.) a person requiring and holding a licence granted by or under the authority of the Food Controller for the purpose of entitling him to use wheat or tailings or screenings of wheat for a manufacturing business carried on by him ; or
- (iv.) in the case of wheat which is suitable for seed, a person buying wheat specifically for the purpose of seed :

and a person not being a person to whom wheat or tailings or screenings of wheat may lawfully be sold under the foregoing provisions of this Clause, shall not buy or offer to buy wheat or tailings or screenings of wheat accordingly.

6. *Sales to be by Weight.*—A person shall not sell or offer to sell any wheat, barley or oats, whether imported or home grown and whether mechanically treated or not, otherwise than by weight.

PART II.—MAXIMUM PRICE FOR DAMAGED WHEAT.

7. *Maximum Price.*—Subject as hereinafter provided, no wheat which has been so damaged as to be unfit for use in the manufacture of flour for human food and no tailings or screenings of wheat which are unfit for use in the manufacture of flour for human food, may be sold by or on behalf of the producer in the case of wheat harvested in the United Kingdom or by or on behalf of the importer in the case of imported wheat, at a price exceeding a price at the rate of 72s. per qr of 504½lb.

8. On the occasion of the purchase of any wheat or tailings or screenings of wheat to which Clause 7 applies from any person other than the producer or importer of the grain sold, the maximum price shall be ascertained by adding 1s. per qr. to the price otherwise applicable according to the foregoing provisions of this Order, provided that where the total quantity purchased by one buyer from one seller does not in any period of seven consecutive days including the day of sale exceed $7\frac{1}{2}$ qr., the maximum price in respect of each qr. so purchased shall be ascertained by adding 5s. per qr. to the price otherwise applicable according to the foregoing provisions of this Order, and where such total quantity does not in that period amount to half a quarter the maximum price in respect of such sales shall be ascertained by adding 9s. per qr. to the price otherwise applicable according to the foregoing provisions of this Order, and where such total quantity does not in that period exceed 28 lb., the maximum price in respect of such sales shall be the actual cost to the seller with the addition of a sum at the rate of $\frac{1}{2}$ d. per lb.

9. *Terms of Trading.*—(a) The maximum price under this Order for wheat harvested in the United Kingdom or tailings or screenings of such wheat, to which Clause 7 applies, are fixed on the basis of the following terms and conditions being applicable to the transaction :—

- (i.) Payment to be net cash within seven days of completion of delivery, and moneys then unpaid thereafter to carry interest not exceeding the rate of 5 per cent. per annum or Bank Rate, whichever shall be the higher.
- (ii.) The grain to be delivered by the producer free on rail or barge, or to mill or store in accordance with the usual custom of the district.
- (iii.) Any freight, haulage, portorage and cartage incurred after delivery in accordance with Sub-clause (ii.) of this Clause, to be for buyer's account.
- (iv.) All sack hire up to and including the time of delivery to rail, barge, mill or store by the producer, to be for the producer's account, and all charges for sack subsequent thereto to be for the buyer's account.

(b) Where the grain is sold on terms and conditions other than the terms and conditions stated in the foregoing part of this Clause, a corresponding adjustment shall be made in the maximum price.

In particular :—

- (i.) Where grain is delivered by the producer to a distance greater than the distance corresponding with the usual custom of the district a sum at the rate of 1s. per ton per mile for the extra distance shall be added to the maximum price.
- (ii.) Where the grain is delivered by the producer at his premises a sum at the rate of 9d. per ton per mile for the distance corresponding with the usual custom of the district shall be deducted from the maximum price.

10. (a) The maximum prices applicable under this Order for imported wheat or tailings or screenings of such wheat, to which Clause 7 applies, are fixed on the basis of the following terms and conditions being applicable to the transaction :—

- (i.) Sales by importers to be *ex* quay, store or granary and grain shipped in bags to be sold gross weight, including bags,

no charge being made for bags. Other terms of sale (except as hereinafter specifically provided) to be in accordance with the usual custom of the trade. All storage, transport and other charges incurred after sale by the importer to be for account of the ultimate buyer.

- (ii.) On sales by importers, payments to be net cash against Bill of Lading Warrant or approved Delivery Order. On all other sales, payment to be net cash within seven days of completion of delivery, and moneys then unpaid thereafter to carry interest not exceeding the rate of 5 per cent. per annum, or Bank Rate, whichever shall be the higher.

(b) Where the grain is sold on terms and conditions other than the terms and conditions stated in the foregoing part of this Clause, a corresponding adjustment shall be made in the maximum price.

11. *Invoice*.—The amount added to the maximum price in respect of charges permitted under Clause 9 and Clause 10 of this Order shall be accurately shown as separate items on the invoice relating to the sale and shall not in any case exceed reasonable expenses actually paid or incurred.

12. *Statement by Vendors*.—Where the maximum price at which grain may be sold by any person depends upon the amount of any sums paid or charged for transport or storage or any other matter by any former seller, such person shall be entitled to rely upon any written statement as to the amount of such sums which may have been given to him by the person from whom he bought the grain in question unless he has reason to suspect the truth of such statement.

13. *Mechanically-treated Grain*.—On the occasion of a sale of any wheat to which Clause 7 applies which has been mechanically treated, or tailings or screenings of wheat to which Clause 7 applies which have been mechanically treated by torrefying, bleaching, gristing, crushing, bruising, kibbling, splitting or other kindred process, or kiln-dried or dried by other mechanical method, the maximum price shall be ascertained by adding to the price otherwise applicable according to the foregoing provisions of this Order the cost of such treatment not exceeding a usual and reasonable charge.

14. A person shall not sell or buy or offer to sell or buy any wheat or tailings or screenings of wheat to which Clause 7 applies at a price exceeding the maximum price applicable under this Order, or in connection with the sale or disposition, or proposed sale or disposition thereof enter or offer to enter into a fictitious or artificial transaction or make or demand any unreasonable charge.

15. *Records*.—Any person dealing in any grain to which Clause 7 applies shall keep accurate records containing such particulars as are necessary to show whether or not he is complying with the provisions of this Order so far as they relate to him or to his trade, and shall make such returns as shall from time to time be required by or under the authority of the Food Controller. All such records and documents shall at all times be open to the inspection of any person authorised by the Food Controller.

PART III.

16. *Definitions*.—For the purpose of this Order the expression "wheaten flour" shall include any flour of which flour obtained from wheat forms part.

The expression "quarter" shall mean a weight of 504 lb.

The expression "unfit for use in the manufacture of flour for human food" shall mean grain which is so damaged or so inferior in quality that any flour or meal which could be milled therefrom would be unfit for use in human food.

The expression "importer" shall mean the person sighting the shipper's draft, but this shall not be construed so as to limit the general interpretation of that expression.

17. The Wheat, Rye and Rice (Restriction) Order, 1917,* the Dredge Corn Order, 1917,† the Damaged Grain, Seeds and Pulse (Prices) Order, 1917,‡ and the Grain (Prices) Order, 1918,§ are hereby revoked, but without prejudice to any proceedings in respect of any contravention thereof, provided that licences granted by or under the authority of the Food Controller under the Wheat, Rye and Rice (Restriction) Order, 1917, and in force immediately before the coming into operation of this Order, shall be deemed to have been granted under this Order.

THE final tabulation of the Returns of Acreage and Livestock collected by the Board of Agriculture and Fisheries will be completed shortly and published. In the meantime

Reduced Area of Corn Crops.

a provisional estimate has been made, based upon 80 per cent. of the returns received. This indicates a slight increase in the area of arable land in 1919 as compared with last year.

There has nevertheless been a substantial decrease in the amount of land devoted to corn crops. The reduction in the case of wheat appears to be 336,000 acres (or 13 per cent.), the total acreage having gone back to two and a quarter millions.

The estimate for livestock indicates that the total number of cattle has been maintained, but that on the whole there has been a slight decrease in the dairy herd. The number of sheep has fallen materially from the very low figure of last year; and the flocks of the country are now smaller than in any previously recorded year. There is a sign of some recovery in the number of pigs as compared with June, 1918.

THE imports of maize during the current year have been very low, but the Ministry of Food have now arranged with the Wheat Commission for maize to be imported into this

Maize Supplies.

country at an increased rate during the remainder of the year. It is anticipated that this will relieve the shortage in this feeding stuff.

IN many districts, particularly in the south of England, spring oats have once again suffered severely from attacks by frit fly

The Sowing of Winter Oats.

("bottling"), while, as heretofore, winter oats have sustained little damage from this pest. It seems desirable, therefore, that winter oats should receive increased attention at the present time.

* See this *Journal*, May, 1917, p. 236.

† " " " December, 1917, p. 1028, and November, 1918, p. 1014.

‡ " " " " p. 1026, and June, 1918, p. 346.

§ " " " September, 1918, p. 742, December, 1918, p. 1128, and March, 1919, p. 1511.

Winter oats are suited to a wide range of soils ; they can be sown on soils too light or too poor for wheat and they can be taken as a second corn crop, provided the land is clean. Further, for land infested with charlock they are better adapted than spring oats.

Winter oats are not so hardy as winter wheat or winter barley, consequently they should be confined to the milder parts of England and should be sown preferably in September, so that the plants may become well established before winter sets in.

For further particulars readers should consult Food Production Leaflet No. 22, obtainable gratis and post free on application to the Secretary, Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1.

THE following Note is published as supplementary to the article on "The Harvesting of Corn Crops," which appeared in last month's issue of this *Journal*, p. 530 :—

The Harvesting of Wet Sheaves.

A device for drying wet sheaves, which is much used on the smaller holdings in rainy districts in Norway, consists of a stake driven upright in the ground. About a foot above the level of the ground a light crossbar, about 2 feet long, is fixed across the stake. The sheaves are then threaded on the stake, so that they lie horizontally with the stake passing through them at the band. The cross-bar keeps the lowest sheaf off the ground. The sheaves should lie alternately head to butt, so that the butt of the upper sheaf protects the head of the lower from rain ; meanwhile, the wind has every chance of getting at them. The stake should be long enough to spike about half-a-dozen sheaves, but the details of the arrangement will depend on the supply of stakes available. Care must be taken not to load a stake beyond its strength.

FARMERS, gardeners and allotment holders are warned to examine closely all potato crops during lifting with a view to discovering the presence of wart disease. This disease has caused serious loss to potato growers in the North and Midlands, and cases have recently been reported in the Southern counties.

Wart Disease of Potatoes.

The success of the work of the Board of Agriculture in safeguarding the potato-growing industry from this disease depends on all cases being made known to them. It is of the greatest importance that potato growers should co-operate with the Board by inspecting their crops and reporting cases or suspected cases at once to the Board or to the police. Failure by any occupier to report disease on his crop renders him liable to a fine not exceeding £10. Further information can be obtained from illustrated posters at police stations and on hoardings.

OWING to the prevalence of wart disease in Montgomeryshire and Denbighshire, the Board of Agriculture have certified the whole of these counties as infected areas under the Wart Disease of Potatoes Order of 1918, with effect from 1st January, 1920.

Wart Disease of Potatoes in Montgomeryshire and Denbighshire.

After that date occupiers of land in the infected areas must plant only those varieties of potatoes approved as immune from wart disease.

For the year 1920 only the following exceptions will be allowed, for planting only on land in which wart disease has not appeared at any time :—

(a) It will be permissible to plant own-grown seed of the first early susceptible varieties—Duke of York (including Midlothian Early), May Queen, Ninetyfold, Sharp's Express and Epicure. A general licence authorising such planting has already been issued.

(b) The Board will issue, on application being made to them, special licences to *bona-fide* market growers to plant fresh seed of first early susceptible varieties.

THE supply of first early potatoes immune from wart disease has in the past been much smaller than the demand. The Board of Agriculture, realising that steps should be taken to

Supply of "Seed" of Immune Varieties. increase the supply, arranged for the planting of a considerable acreage in Scotland this year. Although the weather has been adverse to the production of large crops, a reasonable quantity of Dargill Early is available for distribution to seed growers in all districts and to growers in areas scheduled by the Board as infected with wart disease.

Particulars relating to the distribution and sale of these potatoes can be obtained from the Commercial Secretary, Board of Agriculture, 72, Victoria Street, London, S.W. 1.

IN view of the continuance of the control of meat and live stock during the coming winter, the Food Controller has had under consideration the prices to be paid for live stock until the end of June next.

Prices for Live Stock. The Food Controller has had the benefit of the advice of the Central Advisory Committee on Meat and Live Stock and of the Central Agricultural Advisory Council, and after consultation with the Boards of Agriculture has fixed these prices.

For cattle sold on the *Live Weight* basis the figures are based on the price of 75s. per cwt. for a First Grade, 70s. for a Second Grade, and 65s. for a Third Grade animal, plus in each case an additional sum per cwt., in accordance with the following scale of increases :—

		<i>Per Cwt.</i>				<i>Per Cwt.</i>	
1919.		s.	d.	1920.		s.	d.
September	4	0	9th to 21st February	12	0		
October	4	0	23rd February to 6th				
1st to 15th November	4	0	March	13	0		
17th to 29th November	5	0	8th to 20th March ..	14	0		
1st to 13th December	7	0	22nd March to 3rd				
15th to 27th December	8	0	April	15	0		
29th December to 10th			5th to 17th April ..	16	0		
January, 1920 ..	9	0	19th April to 1st May	17	0		
			3rd to 15th May ..	18	6		
1920.			17th to 31st May ..	20	0		
12th to 24th January ..	10	0	1st June to 3rd July ..	20	0		
26th January to 7th							
February	11	0					

It will be seen that the price payable during August will be continued until the middle of November.

Equivalent prices will be payable in respect of sales of cattle on the *Dead Weight* basis.

A similar sliding scale will apply in the case of sheep. The first increase on the present price will occur in the second half of November and will be at the rate of $\frac{1}{4}d.$ per lb., and the maximum will be reached in the second half of April and the first half of May, when the increase will be $3\frac{1}{4}d.$ per lb.

¶ No increases will be made on the present prices payable in respect of Fourth Grade cattle and of inferior sheep.

The prices mentioned above are the net prices payable to the farmer. In order to be able to transfer stock to butchers at a flat rate throughout the whole period butchers will, after 1st October, be subject to a per head charge. This per head charge is in no sense a profit made by the Ministry of Food, but simply an equalisation charge, the amounts received from the butchers during the earlier period being used to pay the farmers the higher rate when they receive more than the butcher has paid before.

The continuance of the present prices until the middle of November will, it is hoped, ensure an even flow of cattle to the markets, so that the Ministry of Food will not be compelled to require farmers to hold over stock in the same way that it became necessary last year.

At the same time it is felt desirable to point out that only fully mature stock will be accepted at the various grading centres and Government slaughterhouses, and that, in order to prevent difficulties at the markets, farmers must send all immature stock to store markets, and not to grading centres or slaughterhouses.

The prices are intended to encourage the winter feeder to take immature beasts from the summer grazing districts and to reduce the number of cattle being offered for slaughter.

IN exercise of the powers conferred upon him by the Defence of the Realm Regulations and of all other powers enabling him in that behalf for removing doubts, the Food Controller

**The Live Stock
(Sales) Order, 1918:
Notice relating to
In-calf Cows or
Heifers.**

has ordered that notwithstanding anything contained in the Notice of Revocation, dated 29th May, 1919 (S. R. & O. No. 657 of 1919),* the provisions of the Live Stock (Sales) Order, 1918, as amended, relating to in-calf cows or in-calf heifers shall have effect as if the Notice of Revocation had not been given.

ACCORDING to a Notice dated 25th August, the Food Controller has issued a general licence under the Live Stock (Sales) Order, providing for an increase in the prices paid to the farmer

Maximum Live Weight of 4s. per cwt. in the maximum live-weight prices of 1st, 2nd, and 3rd grade cattle during the month of September, and an increase to 1s. 3d. per lb. in the maximum dead-weight price of Class A cattle. The wholesale and retail prices of meat remain unchanged.

* See this *Journal*, June, 1919, p. 342.

THE following Notice was issued by the Ministry of Food on 3rd September :—

As the result of experience gained during the original period of control the Ministry of Food have decided to reorganise the machinery of grading in live stock markets.

The whole of the present appointments in regard to grading will be terminated at the end of September, and the new procedure will be brought into operation on 1st October. On and after that date each Grading Committee will consist of three members, (1) a farmer, representing the farmers tied to the market, (2) a butcher, representative of the butchers who draw the bulk of the supplies from the market, and (3) an independent grader, representing the Ministry of Food. It will be seen, therefore, that the three interests will continue to be represented. The farmers and butchers have a voice in the nomination of the guardians of their respective interests, and the third member of the Committee is the guardian of the interests of the Ministry of Food. The determination of the grading of any beast, or the valuation of any sheep when made by the Grading Committee as above constituted, will be final and not subject as hitherto to revision by a Super-Grader. The grading or valuing will be determined by the Committee of three either unanimously or by a majority.

Wherever possible, it will be arranged for the Ministry Grader to operate in several markets per week. The Ministry members of the Grading Committee will also be responsible for the general supervision of the weighing and allocation of stock. These representatives of the Ministry will be paid a daily fee of 2 guineas and expenses. Nominations for these positions are being invited from the various Farmers' Unions, Live Stock Traders' Associations, and Retail and Wholesale Butchers' Organisations.

A certain number of travelling inspectors of grading will be appointed whose duty it will be to report to Headquarters upon the efficiency of the grading in the various markets.

A Central Grading Committee will be established at the Headquarters of the Ministry and meet at regular intervals in order to deal with all complaints in reference to grading. This Committee will include representatives of all the interests involved.

THE following announcement was issued by the Ministry of Food on 25th August :—

Owing to speculation in cattle cakes and meals, the Food Controller has issued an Order requiring all purchases, sales and dealings in cattle cakes and meals made from copra, cotton seed, ground nuts, linseed, palm kernels, rape seed, rice bran, rice meal, sesame seed, or soya beans, after 15th September, 1919, to be under licence, except dealings in respect of—

1. Contracts entered into before the date of the Order.
2. Purchases by or sales to any one person in any one calendar month not exceeding in the aggregate 4 tons of all kinds of cakes and meals.
3. Purchases by persons for consumption by their own cattle.

The Order also provides for all manufacturers of such cattle cakes or meals to be licensed unless their total manufacture is less than 25 tons per month.

It is proposed to issue five classes of licences, namely :—

1. Manufacturers' licences,
2. Importers' licences,
3. Wholesale dealers' licences,
4. Brokers' licences,
5. Distributing dealers' licences.

Manufacturers' licences will be issued by the Oils and Fats Branch of the Ministry of Food; importers', wholesale dealers', and brokers' licences by the National Cattle Food Trade Association of 19, Mark Lane, London, E.C., and its affiliated Associations; and distributing dealers' licences by the National Association of Corn and Agricultural Merchants of 60, Mark Lane, London, E.C., and their provincial area committees, to whom all applications should be made in the first instance.

THE Board of Agriculture and Fisheries have come to an agreement with the makers of sulphate of ammonia with regard to the maximum prices to be charged for this fertiliser

Prices of Sulphate of Ammonia, October, 1919 to May, 1920. for home agricultural use for delivery in the eight months October, 1919, to May, 1920.

These prices are appreciably higher than those ruling during last season, owing to the fact that the Government subsidy given to makers during the War has now been withdrawn. The agreed maximum prices are fixed on a commercial basis which has to cover the substantial increases which have occurred since last year in the cost of coal, wages and raw materials. The Board consider that these prices are not more than are necessary to secure to the manufacturers a reasonable trade profit.

Agreed Maximum Prices.—For sale in lots of not less than 2 tons for delivery by rail or water to purchaser's nearest railway station or wharf in Great Britain, less a trade discount to agricultural merchants, dealers and co-operative societies

Month of Delivery.	Price per Ton in Bags, net Cash.		
	£	s.	d.
October, 1919	20	10	0
November	20	15	0
December	21	0	0
January, 1920	21	7	6
February	21	15	0
March, April and May	22	0	0

In the case of deliveries to Ireland, Isle of Man or Channel Islands, the above prices include delivery f.o.b. port in Great Britain.

Farmers should place their orders without delay with their usual dealer or co-operative society.

Manure mixers, merchants, dealers and co-operative societies should send their orders to the Sulphate of Ammonia Association, 84, Horseferry Road, S.W. 1.

Conditions of Sale.—(1) The agreed maximum prices are net cash prices for deliveries in lots of 2 tons and over in maker's bags, net weight excluding weight of bags. Where credit is given to the purchaser, a

reasonable extra charge may be made, provided that the discount for net cash is quoted on the invoice, and is such as to bring the net cash price within the agreed maximum price. If purchaser's bags or other packages are used, reasonable allowance shall be made to the purchaser. Where 1 ton or upwards is sold for delivery in bags containing less than 2 cwt. each, a reasonable extra charge may be made beyond the agreed maximum prices which would otherwise have been charged.

(2) For sulphate of ammonia containing more than $24\frac{1}{2}$ per cent. by weight of ammonia, the agreed maximum prices shall be increased by 4s. per ton for each complete one-fourth of 1 per cent. (calculated on the total weight of the sulphate of ammonia) by which the ammonia contents are more than $24\frac{1}{2}$ per cent., whilst for sulphate of ammonia containing less than $24\frac{1}{2}$ per cent. by weight of ammonia, the above agreed maximum prices shall be reduced by 4s. per ton for each one-fourth of 1 per cent. or fraction of one-fourth of 1 per cent. (calculated as aforesaid) by which the ammonia contents are less than $24\frac{1}{2}$ per cent.

(3) For sulphate of ammonia containing less than 0.025 per cent. of free acid, an additional charge at the rate of 5s. per ton may be made by the vendor, provided that the invoice given by the vendor to the purchaser states such additional charge separately, and contains a guarantee by the vendor that the free acid contained in the sulphate does not exceed 0.025 per cent.

(4) For sulphate of ammonia which is specially ground or pulverised at the request of the purchaser, an extra charge (not exceeding 5s. per ton) may be made for special grinding, provided that such extra charge is separately stated on the invoice given to the purchaser as aforesaid.

(5) The above increases or reductions in the agreed maximum prices chargeable shall not apply to any delivery of less than 2 cwt. of sulphate of ammonia.

(6) For deliveries of less than 2 tons or sales of small quantities made ex merchant's store the Board would regard as reasonable the following additions to the price charged for 2 ton lots:—

<i>Quantity delivered.</i>					<i>Additional Price.</i>
1 ton and over	..	..	..	..	10s. per ton.
2 cwt. and over but less than 1 ton.	..	..	..	..	1s. per cwt.
1 cwt.	..	..	2 cwt.	..	2s. "
28 lb.	..	..	1 cwt.	..	3s. "
14 lb.	..	..	28 lb.	..	4s. "

* In the case of sales for delivery to consumer's premises ex merchant's shop or store, the cost of conveyance, charged at local rates, may be added.

THE Government have recently acquired from Germany a quantity of potash salts in exchange for food, and arrangements have now been made by the Board of Trade, in conjunction with the Board of Agriculture, for the distribution of about 40,000 tons for agricultural purposes. The sale of the material will be undertaken by the British Potash Company, Ltd., 49, Queen Victoria Street, London, E.C. 4, under the direction of an Official Committee, to be called the Potash Distribution Committee, on which the Board of Trade and the

**High-grade
Potash Salts for
Agricultural
Purposes.**

Departments of Agriculture for England, Scotland, and Ireland will be represented, together with representatives of trade interests.

The following maximum selling prices have been agreed. The prices are for sales to farmers delivered to nearest railway station in Great Britain or Ireland in lots of not less than 4 tons :—

	Price per Ton net		
	Cash in Bags.		
	£	s.	d.
Potash salts, 30 per cent. K_2O	12	10	0
Muriate of potash, 80 per cent. KCl	20	12	6
Sulphate of potash, 90 per cent. K_2SO_4	23	2	6

Manure mixers, merchants, dealers, and co-operative societies will be allowed a discount on these prices of 7s. 6d. per ton on potash salts, and 10s. per ton on the muriate and sulphate of potash.

The potash will be sold at the above basis prices; and proportionate increase or decrease will be made for higher or lower quality as shown by analysis of a representative sample of each consignment.

Farmers should place their orders without delay with their usual dealer or co-operative society.

Manure mixers, merchants, dealers and co-operative societies should send their orders to the British Potash Company, 49, Queen Victoria Street, London, E.C. 4. Special terms may be arranged for purchases ex ship.

For sales of small quantities made ex merchant's store the Board would regard as reasonable the following maximum additions to the price charged for 4-ton lots :—

Quantity delivered.				Additional Price.	
1 ton and over .. ..	..	..	..	10s.	per ton.
2 cwt. and over, but less than 1 ton ..	..	..	..	1s.	per cwt.
1 .. ..	..	..	2 cwt.	2s.	..
28 lb. .. ..	..	..	1 cwt.	3s.	..
14 .. ..	..	..	28 lb.	4s.	..

In the case of sales for delivery to consumer's premises ex merchant's shop or store, the cost of conveyance, charged at local rates, may be added.

No potash of a lower grade than 30 per cent. salts is available under the above arrangement, but licences are being granted to the Alsace-Lorraine Trading and Development Company, 54, Gresham Street, London, E.C. 2, for the importation of 20,000 tons in all of kainit (14 per cent. K_2O) and sylvinit (20 per cent. K_2O). Farmers who wish to purchase potash of these grades should apply to their usual dealers.

Mr. McCURDY, K.C., M.P., Parliamentary Secretary to the Ministry of Food, addressing a meeting of the Consumers' Council at Palace Chambers, Westminster, on 27th August,

Milk Prices.

made an important statement on *milk prices in the coming winter, and the power of Local*

Authorities. Mr. McCurdy said :

"In a few days from now we may expect an announcement* of the wholesale milk prices which will be fixed by the Food Controller for next winter. I cannot yet say what the actual schedule will be. The matter has been very fully discussed with the Consumers' Council and

* See p. 650.

with the representatives of agriculture, and some adjustments may still have to be made. But we must be prepared *for a retail price of one shilling a quart next winter throughout the country.*

I know that statement will be very unwelcome to you. A price of one shilling per quart is *a price pregnant with possibilities of public dissatisfaction and unrest.* But I am afraid it cannot be avoided. Indeed, producers will probably consider that it ought to be higher. I shall not now attempt to discuss the reasons which make an increase of price in my judgment unavoidable. The increased costs of production on the one hand, and the interests of the consumer on the other hand, have received most anxious and painstaking consideration by my Right Hon. Friend, the Food Controller, who will no doubt himself deal with this question when the new schedule is published.

But there are certain consequences of this increase in the price of milk which we ought at once to consider, if unnecessary hardship and suffering is to be avoided.

A price of one shilling per quart means a considerable increase in the number of working-class families unable to afford an adequate supply of milk.

There will be less milk consumed, and unless steps are taken to meet the difficulty, the child population of the United Kingdom will be the principal sufferers.

I want the public to know the true facts about the national milk supply, as we have learned them during our experience at the Ministry of Food. First of all let me say that the milk supply of the country has never been adequate to our needs.

For 40 years the production of milk has not kept pace with the growth of the population. Before the War we had fewer cows to the hundred acres than any country in Europe except France.

Our supply is deficient both in quantity and in quality, and the methods of distribution leave much to be desired.

When the Astor Committee was appointed in 1917 to investigate our milk supply, they discovered that before the War when the price of milk was only 4d. a quart, the average consumption of milk by the working-class family was only 2 pints per head per week, and the total milk supply was not enough to give half a pint a day all round. In some industrial areas there are whole streets which never see fresh milk at all.

To understand what this means to the health of the nation we have to realise that milk is the essential food of the children. Up to five years of age, the doctors tell us, every child ought to have a quart of milk a day. The children of the well-to-do classes may get it, the children of the working classes do not. If this was the unsatisfactory state of things when milk was 4d. a quart, how is the working-class family to give the children a full and adequate supply of milk when the quart costs a shilling?

Dear milk means increased infant mortality and there is nothing that can take its place.

In the coming winter steps must be taken to see that the increased price of milk shall not mean the massacre of the innocents. *The remedy is not to fix lower prices than are necessary to give the farmer a profit. We cannot afford to starve the farmer. A fair price to the farmer is essential to any chance of increasing or even maintaining our present milk supply.*

But in this matter the local authorities have powers conferred on them by an Order of the Ministry of Food made last year, which should

not be overlooked. Subject to such conditions as may be laid down by the Food Controller any local authority may arrange for the supply of milk for children under five years of age, and in necessitous cases such milk may be sold at less than cost price or may be supplied free. As a general rule we should all agree that anything in the nature of a subsidy of food is undesirable for many reasons, but there are exceptions to every rule. During the War it was found necessary to make an exception in the case of bread. Until there is a big fall in the price of milk it may be necessary, and I believe it will be necessary, for local authorities to exercise in a liberal and sympathetic spirit the powers which they already possess for ensuring that the children of Great Britain shall not be allowed to suffer by reason of the economic crisis through which the world is now passing. Some local authorities are doing so now. Some I regret to say are not. If the present Order under which milk may be supplied to mothers and children should not be found to be sufficiently comprehensive to enable local authorities to deal adequately with the situation which will be created if milk should rise to so high a price as 1s. a quart I am sure that my Right Hon Friend, the Food Controller, will take steps to amend or enlarge the powers which he has already conferred."

In concluding, Mr. McCurdy said :

" We have to make good the wastage of human life that took place during the War. *Our baby crop for the years 1914 to 1919 is in danger! We must save it.*"

At a meeting of the Consumers' Council held at the Ministry of Food, on Wednesday, 27th August, 1919, the following Resolution was adopted :—

" That the Consumers' Council, having heard Mr. McCurdy's statement, view with alarm the suggestion that the winter price of milk may increase the retail price to the public to 1s. per quart, and are convinced that it will cause great unrest in the country and immense suffering, particularly amongst the infant population, and urge upon the Government the absolute necessity of taking steps forthwith to keep the price down to such a level as will enable the children of the poorer classes to get sufficient supplies."

THE following Notice was issued by the Ministry of Food on 27th August :—

One of the abuses to which the fixing of
" **Maximum** " Prices. maximum prices by the Food Controller has led is that though the prices are merely
" maximum prices " they are treated as fixed prices, and the Ministry of Food is blamed on the ground that but for the " Government price " the article would be sold cheaper,

Again, placards with " Government controlled prices " or similar expressions are used which suggest that the Government is authorising the prices charged, *e.g.*, when very inferior apples are sold at the full maximum of 9d. per lb.

The Food Controller has, therefore, made an Order definitely prohibiting the use of any notice containing the words " Government

price," "controlled price," or similar expressions unless the word "maximum" is inserted immediately before the word "price" in each case, or unless the notice or statement in some way states clearly that the price referred to is the highest price that may be charged.

This Order came into force on 3rd September, 1919.

THE Ministry of Food announce that the Cream Order, 1918, the operation of which was suspended on 12th April last, again becomes operative as from 1st September. As from

**Revival of Cream
Order, 1918.**

that date the sale of cream again becomes prohibited except for purposes of making butter or for such purposes as the Food Controller may from time to time authorise.

THE Food Controller announces that he has decided to fix the maximum prices for wholesale sales of milk by or on behalf of the producer throughout Great Britain for the months October, 1919, to April, 1920, inclusive, as follows :—

<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	
2/2	2/8	3/3	3/3	3/-	3/3	2/2	per gal.,

together in each case with a sum equal to the net amount for the charges for railway transport actually incurred by the seller. The average of the above maximum prices (excluding the railway charges) is 2s. 9½d. per gal. These prices have been agreed to by the President of the Board of Agriculture and Fisheries.

Where the milk is collected by the buyer from the premises of the seller the maximum price will be ascertained by deducting 1d. per gal. from the above prices. Where milk is sold whole sale by or on behalf of any person other than the producer, the maximum prices will be as follows :—

In the case of milk delivered by the producer to or for the account of the buyer in accordance with the directions of the seller, ½d. per gal. higher than the corresponding price chargeable to the seller by the producer.

In the case of milk not so delivered—

(1) When delivery is made to the buyer's railway station or at the seller's premises :—

<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	
2/5	2/11	3/4	3/4	3/4	3/2	2/5	per gal.

with in addition the net railway charges (if any) paid by the seller for transportation from the seller's station to the buyer's station.

(2) When delivery is made to the buyer's premises :—

<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>	
2/11	3/3	3/5	3/5	3/5	3/4	2/11	per gal.

The figures stated in (1) above give an average monthly margin of 2d. per gal. and in (2) an average monthly margin of 5d. per gal., which

are the same margins as were allowed under the Milk (Summer) Prices Order, 1919.*

The Food Controller has also decided to fix the maximum retail prices as follows :—

<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>Apr.</i>
11d.	1/-	1/-	1/-	1/-	1/-	11d. per qt.

The Order fixing all the above mentioned prices will be issued at an early date.

The maximum retail prices will, as under previous Orders, be subject to appropriate reduction in the various Food Control Committee districts according to the local costs of distribution. On the previous experience of the Ministry it is not expected that the maximum retail prices set out above will be applicable in more than about 8 per cent. of the 1,831 Food Control Committee districts.

The Food Controller recognises with grave concern that these retail prices show a substantial increase over last winter's prices, but he is satisfied that, in view of the increased costs of production, they cannot be fixed at a lower level without injustice to the producer and consequently without endangering future supplies.

On the other hand, he is of opinion that producers and distributors are not permitted under these scales to obtain an unreasonable profit. He desires, however, with the concurrence of the Minister of Health, to draw attention to the power vested in local authorities to provide milk for expectant and nursing mothers and for children under five years of age, through maternity and child welfare centres and otherwise, at a reduced price or free of cost in cases in which the local authorities are satisfied that circumstances justify the provision. The Ministry of Health make a grant of half the expenditure incurred by local authorities and by voluntary societies in supplying milk at less than cost in such cases where the arrangements are approved by them. The Minister of Health is communicating with local authorities on this subject.

THE Land Settlement (Facilities) Bill, having received Royal Assent, the Board of Agriculture are issuing at once to all County Councils and Councils of County Boroughs a Circular

Land Settlement. Letter, urging them to put into operation forthwith their extended powers to acquire and compulsorily and to obtain vacant possession of land acquired by agreement.

Returns have been received from 57 County Councils, showing that, up to 23rd August, of 25,161 applicants for small holdings 12,111 had been interviewed. Of the number interviewed 10,443 had been approved. The approved applicants comprise 9,739 who require small holdings amounting to 183,577½ acres, and 704 who require cottage holdings amounting to 2,590 acres.

The total area of land acquired or agreed to be acquired by County Councils since 20th December, 1918, with the Board's approval, was

* These prices were published in the *Journal*, May, 1919, p. 198.

77,816 acres, of which 71,023 acres are in England and 6,793 acres in Wales.

In addition the Board had under consideration proposals by County Councils for the acquisition of 96,821 acres, including 13,101 acres which the Councils propose to acquire by the exercise of compulsory powers. Of this total 86,388 acres are in England and 10,433 acres in Wales.

It is now possible to accept a few ex-officers for the Board's Farm Settlement at Bosbury, Herefordshire, which will be devoted to mixed farming and fruit growing. The accommodation available at present is, however, meagre,

Farm Settlements for Officers.

and therefore only officers who are willing to go into lodgings or to live together in army huts can be accepted. The erection of new cottages is being arranged for. In the first instance, ex-officers will be accepted as wage-earners only, but it will be possible to provide a few small holdings at Bosbury at a later date. The land not divided into small holdings will be farmed as a whole on the profit-sharing system described in the leaflet L.S. 2, copies of which may be obtained gratis and post free on application to the Board (Land Division), 72, Victoria Street, London, S.W. 1. Officers who have had the necessary agricultural experience will be accepted as probationers and after six months will become entitled to share in the profits.

The Board have also acquired an estate of 1,065 acres near Wantage, Berkshire, which they propose to devote to the land settlement of ex-officers, and in addition to accept as settlers a few women. In this case also the land will be farmed as a whole on the profit-sharing system. The type of farming will be dairying. Vacant possession will be obtained on 29th September next, and a number of officers can be accepted at once to commence work on that date. Several old cottages will be available and army huts are being erected for temporary use as a hostel. Accommodation may also be obtainable in the town of Wantage, about one mile distant from the estate. A few new cottages will be erected as soon as possible.

It will be observed that no small holdings for officers are at present available at any Settlement, and such men who require holdings of their own at the outset are advised to apply to their County Council. Officers who have risen from the ranks can be considered for acceptance at *any* Farm Settlement if they so desire.

THE following Circular Letter (No. 167/c 6) was addressed to County Councils and Councils of City Boroughs by the Board on 26th August :—

SIR,—During the discussion in Parliament

Land Settlement: of the Land Settlement (Facilities) Bill strong
Compulsory Hiring. representations were made as to the disadvantages of purchasing land at its present high price, in view of the possibility that such price will not be maintained, and the Parliamentary Secretary of the Board undertook to point out to Councils the advantages under present conditions of proceedings by means of compulsory hiring when land cannot be obtained by agreement at a reasonable price or rent.

I am directed, therefore, to call your special attention to the powers which are possessed by your Council to hire land compulsorily under the Small Holdings and Allotments Act, 1908, and the Land Settlement (Facilities) Act, 1919. A Council can make an Order, which will not have to be submitted to the Board for confirmation, authorising them to hire land compulsorily for a period of not less than 14 years and not more than 35 years, and the hiring can be renewed under section 44 of the Act of 1908, for a further period of not less than 14 years and not more than 35 years on giving notice to the landlord not more than two years and not less than one year before the expiration of the tenancy. The amount of the rent in the first instance will be fixed, in default of agreement, by an official arbitrator, who is required to take into consideration the rent (if any) at which the land has been let, the annual value at which it is assessed for income tax or rating, the loss (if any) caused to the owner by severance and the terms and conditions of the hiring, but he shall not make any allowance in respect of any use to which the land might otherwise be put by the owner, being a use in respect of which the owner is entitled to resume possession. On renewal of a compulsory hiring tenancy the landlord may claim a re-assessment of the rent, but the valuer is directed not to take into account any increase in the value of the land due to—

- (a) improvements carried out by the Council in respect of which they could claim compensation on quitting ;
- (b) any use to which the land might be put, being a use in respect of which the landlord can resume possession, *e.g.*, building, mining or other industrial purposes ; or
- (c) due to the establishment by the Council of other small holdings or allotments in the neighbourhood.

The compulsory hiring provisions of the Acts enable Councils, therefore, to obtain a perpetual tenancy of land at a fair rent, which cannot be raised in consequence of their own improvements, and without regard to any prospective value which the land may possess for building, mining or other industrial purposes, but subject to the landlord's right of resumption if he satisfies the Board that he requires the land for such purposes. A Council can also at any time make use of their powers of compulsory purchase in respect of any land which they have hired compulsorily.

I am directed to suggest, therefore, that during the present period your Council should consider whether they would not be well advised to proceed by way of compulsory hiring until such time as land values have reached a more normal and settled level. The Board are aware of the fact that as a general rule Councils prefer purchase to hiring, especially when works of equipment and adaptation are necessary, but I am to say that, in view of the power of renewing the tenancy of land hired compulsorily and of the provisions in regard to compensation for improvements in section 47 (2) of the Act of 1908, the Ministry of Health are prepared in suitable cases to consider whether loans for equipment on land hired compulsorily cannot be sanctioned for the same periods as would be granted if the land had been purchased.

I am, etc.,

(Signed) A. D. HALL,

Secretary.

THE following Circular Letter (No. 191/L.6) was addressed to Agricultural Executive Committees by the Board on 22nd August :—

Training and Placing Board of Agriculture and Fisheries to refer
in Agriculture of to the Board's Circular Letter of the 31st
Able-bodied March last (C. L. 170/L.6),* and I am to
ex-Service Men. enclose for your information a list of centres

for the training of able-bodied ex-Service men which (a) have been actually established and (b) are in course of establishment.

2. On the information at present before them as to the demands by able-bodied ex-Service men for agricultural training the Board do not consider that any further centres for able-bodied men should be established by Agricultural Executive Committees, but every endeavour should be made by Committees to utilise the facilities for training which are afforded by the centres referred to in the list and to make these facilities known to employment exchanges.

3. Committees of the counties in which centres are established should advertise the fact that suitable able-bodied ex-Service men can be received for training and should endeavour to secure that on completion of training the men are placed in employment with farmers at the ordinary agricultural wage.

4. Arrangements should be made by Committees for men who apply for training in a county in which a training centre has not been established to be interviewed by an Officer of the Committee of that County, and if regarded by him as suitable to be accepted for training, at a convenient centre, without the necessity for the men to be further interviewed by an Officer of the Committee of the county in which the centre is actually situate. The Government railway tickets provided for disabled ex-Service men can be used also for able-bodied ex-Service men in the following circumstances only :—

- (a) To enable an applicant for training to be interviewed with regard to his selection for training.
- (b) To enable a man accepted for training to report at the training centre and to return to his home or employment at the completion of his training.

5. Certain Committees have raised some objection to the training of able-bodied ex-Service men at centres for so short a period as 6 to 8 weeks, and have advocated that they should be placed for training with farmers under a "subsidy" system. The chief objection raised appears to be that a period of from 6 to 8 weeks is too short to enable an unskilled man to acquire sufficient agricultural experience to warrant his being paid as a skilled man by a farmer. The Board are considering the question of obtaining Treasury authority to increase the period of training where necessary, but in the meanwhile they would urge Committees to make every possible endeavour to carry out the existing arrangements.

6. As regards the placing of unskilled able-bodied men for training with farmers under a "subsidy" system the Board recognise that this has advantages, but they considered that it is attended by disadvantages which are difficult to overcome.

* Printed in this *Journal*, April, 1919, p. 101.

For instance, it would be necessary to ensure that a man was not merely retained so long as the employer receives a "subsidy" and dispensed with as unsuitable when the period of Government assistance expired. Objection has also been taken by Labour organisations to men being sent out to a farmer under a scheme involving the payment of a Government subsidy.

The Board, therefore, decided that the best plan to adopt would be to set up training centres where such men could become acquainted with farm conditions and receive a certain amount of elementary training before actually being placed in employment with farmers. This scheme, moreover, has the advantage of establishing clearing centres where men can be sorted out who are never likely to prosper on the land. Some of those who desire to take up agricultural work may find that the conditions are not congenial and may wish after a few weeks to return to their former employment or take up other employment.

The Board feel that it is in the interests of all concerned that only those men should be sent to farms who have shown aptitude for work on the land, and this consideration has influenced them in recommending the establishment of training centres.

I am, etc.,

(Signed) A. D. HALL,
Secretary.

ENCLOSURE.

(a) Centres Established.

County.	Address of Centre.	Class of Instruction.	Total Accommodation provided.
Cheshire	Highfield Hall Farm, Bredbury, Stockport	General farm work.	20
Cornwall	Racecourse Farm, Bedmin		10
Kent	Eynsford, near Swanley Junction, Dartford		40
Norfolk	Bacton Hall Farm, Bacton, Norwich		10
Nottingham	Corporation Farm, Bulcote, Nottingham		50
Staffordshire	Rodbaston Hall, near Stafford		20
Suffolk (East)	Hinton Hall Farm, Darsham, Saxmundham		25
Surrey	Park Farm, Lingfield		50
Sussex (West)	Backsett Town Farm, Henfield		15
Worcestershire	Allsebrough Farm, Pershore		10
*Suffolk	Shippea Hill Training Centre, Sedge Fen, Lakenheath, Brandon	Fruit and vegetable growing.	25

* This particular centre is under the direct control of the Board, to whom communications concerning it should be addressed. The next courses start on 8th September and 3rd November, 1919, respectively. Entries for the courses starting on 8th September are now complete.

N.B.—The Brentwood training centre for tractor driving is being closed entirely, and no more men will be accepted for training in tractor driving.

(b) Centres being Established.

County.	Address of Centic.	Class of Instruction.	Total Accommodation provided.
Cornwall	Wadfast Moor, Launceston	General farm work.	10
Gloucestershire	Manor Farm, Quedgeley, near Gloucester		30
Leicestershire	Buckminster, near Melton Mowbray; and Ragdale, near Leicester		40
Somerset	Haydon Grange and Temple-down Farms, Compton Martin, near Bristol ..		20
Yorkshire (W. Riding)	Green Lane Farm, Doncaster		12
			20

THE Board have had under consideration the question of safeguarding the supply of coal required in agriculture, and after consultation with the Coal Mines Department it has been decided

Coal for Agricultural Purposes.

that supplies of steam coal for agricultural purposes shall be sent to convenient centres throughout England and Wales as requested by this Department. This coal will be held in reserve at the various depots and only released on the written authority of the Local Fuel Overseer. All steam coal required for agricultural use must be obtained by consumers through the merchants supplying them with coal for household purposes. A system of rationing, as explained in the Notice printed below, will be maintained, and in the case of individual consumers who make application for steam coal in excess of the scheduled rate, as was done last season, the matter will be investigated and adjudicated upon by members or officers of District or County Committees nominated by the Agricultural Executive Committee. Cases of doubt or difficulty will be referred by such officers to the Executive Committee, who in turn, will, if necessary, refer to the Board.

In order to carry out this scheme for supplying steam coal it will be necessary for the Board to be furnished with an estimate of the requirements of each Agricultural Executive Committee calculated on the basis of the ration already mentioned.

Pending the provision of steam coal at the various depots local fuel overseers have been instructed to meet the requirements of agricultural consumers out of any supplies that may be available. Farmers and others are urged to make early application to their coal merchants for any steam coal which they will require for agricultural purposes before 31st December next.

Notice as to the System of Rationing of Coal for Agricultural Purposes, issued by the Coal Mines Department.

Experience shows that coal for agricultural purposes is usually purchased with house coal because agricultural operations are usually carried on in connection with a farm house or farm estate containing houses. It has therefore been decided that this coal comes within the scope of Clause I. of the Household Fuel and Lighting Order, 1918,

and the Household Fuel and Lighting (Scotland) Order, 1918, and negotiations have been completed with the Boards of Agriculture concerned for its control :—

The arrangements agreed are as follows :—

- (1) Fuel for agricultural purposes includes fuel required for :—
 1. Steam cultivation.
 2. Steam threshing only.
 3. Steam threshing and chaff cutting or baling.
 4. Steam pumping.
 5. Agricultural blacksmiths.
 6. Cattle rearing and feeding.
 7. Pig keeping.
 8. Dairy farming.
 9. Cheese making.
 10. Poultry keeping.
 11. Other food production purposes.
 12. Market gardens and nurseries.
 - (2) Applications for fuel for agricultural purposes must be made :—
 - (a) On form F.H.F. 6 for quantities not exceeding 5 tons where the decision of the Local Fuel Overseer, subject to appeal to the Local Fuel and Lighting Committee, is to be final ;
 - (b) On form F.H.F. 4 where the supply of fuel for these purposes is dealt with in connection with the supply of fuel and lighting to any premises as a whole. In this case the decision will be that of the Local Fuel Overseer, subject to appeal as above ;
 - (c) On form F.H.F. 9A. This form must be used for all special supplies exceeding 5 tons, and for all supplies in respect of which a certificate is to be submitted from either the Agricultural Executive Committee or District Officer referred to below.
 - (3) Certain scales of allowance have been agreed with the respective Boards of Agriculture for the above purposes. Where an allowance is claimed in excess of the amount granted under the scale or where the evidence in support of a claim is not adequate or satisfactory a certificate must be supplied by the applicant from either the Agricultural Executive Committee for the County or the responsible District Officer nominated by the Committee for the purpose.
- The Local Fuel Overseer will advise applicant if a certificate is necessary and may refer any claim made upon him to the proper authority for a certificate.
- (4) The necessary forms can be obtained from the Local Fuel Overseer for the district and should be supplied as required by registered coal merchants and licensed coal dealers to consumers.

THE Board desire to impress upon all fruit-growers, small holders, and allotment holders, the necessity for conserving as much as possible of the present season's crops of fruit and vegetables for use during the coming winter. Those who require information as to the best methods of preservation should write to the Agricultural Education Committee for their county for particulars of any demonstrations that have been arranged, or to the Secretary,

Board of Agriculture and Fisheries, 3, St. James's Square, S.W. 1, for the Board's leaflets on the subject. Envelopes or post cards should be marked "Leaflet Room," and need not be stamped.

The Board are prepared to give instruction to a limited number of persons, who are unable to obtain training from their County Committees, at their Canning Kitchen in London. The courses will last five days and will include instruction in :—

1. *Simple Science*, governing the various methods of fruit and vegetable preservation, and explaining the various reasons of failure.
2. *Various Methods of Preservation*.—
 - (a) Bottling in all phases, including bottling in water and syrup and pulping for jam-making.
 - (b) Jam, marmalade, and jelly making.
 - (c) Brining and pickling, and the making of sauces, chutneys, and fruit syrups.
 - (d) Canning, for use when large quantities of fruit are dealt with.
 - (e) Crystallising and drying.

Persons desirous of attending one of these courses should make a written application to the Secretary, Board of Agriculture and Fisheries, 72, Victoria Street, London, S.W. 1. The courses are given free of charge, and the first course commenced on 25th August, 1919.

THE Board of Agriculture and Fisheries desire to give notice that they have ceased to supply the Royal Home Canner and Cans for fruit preserving. The remainder of their stock of these articles will be offered for sale by the Disposal Board.

**The Royal Home
Canner.**

EXPORTERS of cattle from the United Kingdom to South Africa are informed that arrangements have now been made to comply with the legislative requirements of the Government of the Union of South Africa in respect of cattle exported from a country where a Government Testing Station exists, viz., that the animals must be (1) isolated at the Station, immediately before exportation, for the purpose of undergoing the tuberculin test; and (2) accompanied by an official certificate indicating that they have successfully passed the test. The Union Government do not forego their right to test any animal on arrival in South Africa, but it will not be subject, as heretofore, to 28 days' isolation before being tested.

The Board of Agriculture and Fisheries are accordingly prepared, as from 18th August, to receive cattle at the Government Testing Station at Pirbright (Surrey), where they will be isolated for a period of at least 28 days before being subjected to the tuberculin test. After 31 days from the date of their arrival at Pirbright, animals which successfully pass the test will be available for removal for direct shipment. The necessary official certificate will be supplied to the owner or to his representative for transmission to South Africa with the bill of lading.

Animals which fail to pass the tuberculin test at Pirbright will be disposed of according to the owner's instructions; or consigned at his risk and cost to the premises from which they were sent. If any animal

which has passed the test at Pirbright is rejected by the South African Authorities after being re-tested on arrival, the Board will be prepared to consider the readmission of the animal into this country.

Cattle which are shipped from England within two months of the opening of the Government Testing Station at Pirbright (*i.e.*, before 18th October, 1919), will be admitted into the Union of South Africa under the conditions hitherto in force.

The requirements here indicated also apply to cattle consigned to South Africa ports in transit to other destinations.

Forms of application for the reception of cattle at the Government Testing Station, with detailed information as regards the despatch of the animals to and from Pirbright, the fees payable, etc., may be obtained on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W. 1.

Exporters are reminded that the export of live stock from this country is at present prohibited, but licences are issued in certain cases on application to the Secretary, War Trade Department, 4, Central Buildings, Westminster, London, S.W. 1. Application for an export licence should indicate whether the animals to be exported are pedigree stock.

THE Village Clubs Association is making progress. At an Executive meeting of the Association (Sir Henry Rew in the Chair) a scheme for mutual co-operation between the Soldiers' Clubs Association, the Federation of Women's Institutes and the Village Clubs Association was discussed. A sub-committee from each of the above organisations has been formed to further this object.

Meetings have been addressed lately in Berkshire, Staffordshire and Wiltshire, and great interest is being shown in the association in country districts generally. A large number of inquiries from all parts of England and Wales has been received during the past six weeks. Over 300 existing clubs and institutes have been written to, and a circular setting forth the advantages of affiliation to the Association have been sent to these clubs. Arrangements have been made with lecture societies to supply lecturers to address village audiences on subjects of general interest, such as natural history, travel, etc.

Plans and estimates for building village clubs of steel and concrete are being considered. It is suggested that club premises could be built of this material, in three different stages, commencing with a main hall, to which wings could be added at a later date, as funds become available, the price quoted for the hall only, size 40 ft. by 25 ft., being about £450. Further information on the subject is to be obtained.

THE President has appointed a Committee to advise the Board upon the organisation of threshing and rates of payment for threshing operations during the coming season.

Appointment of Advisory Threshing Committee.

The Committee consists of the following members:—Mr. John Allen, O.B.E., Mr. Thompson Close, Mr. A. M. Cole, Mr. F. M. Elgar, Major P.B. Foster, Mr. H.G. Richardson, Mr. G. Thurlow.

Mr. H. G. Richardson has been appointed to be Chairman, and Mr. P. Barker to be Secretary, of the Committee.

THE following Circular Letter (No. 336/M. 6) was addressed to Agricultural Executive Committees by the Board on 4th September :—

**Organisation of
Threshing.**

The Board have had under consideration the question of continuing during the present season the organisation in force in the season 1918-1919. The liquidation of the Tractor Scheme will involve the withdrawal of all Government-owned threshing tackle not later than the end of September, and already the majority of the threshing boxes provided by the Department last season have been sold. This fact modifies the position considerably inasmuch as any organisation must depend upon agreement between the local threshing proprietors and the Agricultural Executive Committee. There is every reason to believe, however, that in private hands these boxes will perform more work than was possible in the circumstances in which they were operated under Government control, and this will in itself tend to ease the situation. Other factors contributing towards this end are the release of engines by the Forage Committee and the return of men from the Army.

In view of these circumstances and of the fact that crops will be considerably lighter this year, it is anticipated that in many counties there will be no need for a special organisation to secure that the season's threshing shall be done in good time. There are, however, two points which require attention—prices, and the threshing of the stacks of smaller farmers and on farms in outlying districts. Where difficulties in any of the directions indicated are anticipated it is suggested that the Agricultural Executive Committee should reconstitute a Threshing Sub-Committee, on the lines set out in circular letter 89/M. 6 of the 11th March last,* whose duty it would be to come to an arrangement with the local threshing proprietors whereby reasonable rates would be charged and the interests of small farmers and outlying districts would be safeguarded. The Sub-Committee would also, if this course were considered necessary, take steps to divide the county into convenient areas which would be allotted to particular threshing sets on precisely the same lines as were adopted last year.

In considering the standard rates which would be fair and reasonable in any county, it should be borne in mind that threshing contractors, as in the case of all other industries connected with agriculture, have had to face very greatly increased costs, and it is to be apprehended that recent changes in the hours of labour will in many, if not in most, cases prevent threshing upon Saturdays. From the information which is before them, the Board consider that an advance of from 100 per cent. to 150 per cent. upon 1914 rates is not unreasonable: the actual amount of the advance will clearly depend upon local conditions, and in this connection it is to be remembered that before the War threshing rates were in many instances unduly low.

The Board have reconstituted the Threshing Advisory Committee which was set up last year, and it is suggested that in the event of the Threshing Sub-Committee and the trade being unable to agree on any important point the case should be brought to the notice of the Board, who will refer the matter to the Advisory Committee.

* Not printed in this *Journal*.

It is hoped that Threshing Sub-Committees will be able to secure the active co-operation of the trade, but if any threshing owner will not fall into line with the reasonable requirements of a Sub-Committee, the Board will be prepared, in suitable cases, to exercise their powers under paragraph 2M of the Defence of the Realm Regulations. It would be necessary for a Committee to place before the Board full particulars of any such case, and to obtain the written consent of the Board before steps were taken to requisition any threshing machinery.

It is requested that your Committee will consider the question of threshing at an early date, and notify the Board as soon as possible whether it is proposed to take special steps to organise threshing in their county.

I am, etc.,

(Signed) H. G. RICHARDSON,
for Assistant Secretary.

THE Food Controller has issued a General Licence (Order No. 1167) under the Caerphilly Cheese (Retail Prices) Order, 1919, providing that on and after 2nd September, 1919, until further notice Caerphilly cheese may be bought or sold free from the restrictions imposed by the Order.

**Caerphilly Cheese
Prices.**

No case of Foot-and-Mouth Disease has been confirmed since the 20th August in the Warwickshire Scheduled District. The Board have, therefore, been able materially to reduce the restrictions imposed on account of the outbreak at Kingsbury on 2nd August (see this *Journal*, August, 1919, p. 565). Although very close inquiry has been made no evidence has been obtained as to the origin of the initial outbreak.

**Foot-and-Mouth
Disease.**

An outbreak of Foot-and-Mouth Disease was confirmed by the Board at Wyke Regis, Weymouth, Dorsetshire, on 11th September, and an Order was issued on that date prohibiting the movement of animals over a considerable area surrounding the infected premises.

THE total number of outbreaks of Rabies confirmed is now 242, namely, 102 in Devon, 27 in Cornwall, 74 in Glamorgan, 11 in Monmouth, 2 in Gloucester, 7 in Middlesex, 11 in Surrey, 1 in London, 2 in Kent, 1 in Berkshire, 1 in Brecknock and 3 in Essex.

Rabies.

THE Board are informed by the Ministry of Food that the Malt (Restriction) Order was revoked on the 29th August. Persons desiring to purchase malt for home brewing will, therefore, no longer be under the necessity of obtaining a Permit from the County Agricultural Executive Committee.

**Malt for Home
Brewing.**

THE Agricultural Land Sales (Restriction of Notices to Quit) Act, 1919, became Law on the 19th August. The effect of the Act is that,

Land Sales and Notices to Quit. except by agreement with the occupier, the tenancy of an agricultural holding which passes by sale to a new owner cannot be terminated by a Notice to Quit served prior to the making of the contract of sale and then current and unexpired. Tenant farmers whose land is sold over their heads are, therefore, assured of having a considerably longer period within which to make their arrangements than was the case prior to the passing of this Act.

Copies of the Act may be purchased, price 1d., through any bookseller or directly from H.M. Stationery Office, Imperial House Kingsway, W.C. 2.

THE scheme constituting the Welsh Office came into operation on the 1st September, and as from that date the Board's business in Wales will be conducted through the Welsh Office, particularly business relating to Agricultural Education, the work of the Agricultural Executive Committees, that part of the work of the Agricultural Executive Committees (except claims for compensation) which has hitherto been dealt with by the Land Division and the provision of facilities for Land Settlement by County Councils. The business of the Welsh Agricultural Council will be conducted at the Welsh Office.

The address of the Welsh Office is:—Board of Agriculture and Fisheries, Welsh Office, 24, Marine Terrace, Aberystwyth.

In this *Journal* for July, 1919, page 367, in the article "The Effect of Drying on Germination of Cereals," **July Journal:** line 15 from the bottom, for the word *Erratum.* "increased" read "decreased."

Hartley Wintney.—Sdney Grove, Southwood Farm, Cove, for contraventions of the Live Stock (Sales) Order and the Slaughterhouses Licensing Order, £35.

Prosecutions of Farmers, etc., under Statutory Rules and Orders. *Melton Mowbray.*—George Abbott, farmer, was charged with selling milk to H. Hardy, a Walthamstow dairyman, at 2s. 3d. together with a "bonus" of 2½d. per gal. Mr. C. H. Hornby prosecuted for the Ministry, and the defendant was represented by Mr. Barlow, who urged that, as the dairyman had paid his account and deducted the excess charges, no offence had been committed. The Bench, of whom four out of six magistrates were farmers, imposed a penalty of £35, with £15 special costs.

Nottingham.—A. H. Steeples, Newthorpe, for slaughtering two sheep which were not sold in a market, using a cart-shed as a slaughterhouse, and irregularly slaughtering a calf, £30.

Petworth.—Alfred Luckin, Orfold Farm, Wisborough Green, and Wm. James Herbert, Penge, for entering into a fictitious transaction on milk (nine cases), £62 each.

Stratford.—Frank William Brown, Folly Farm, Walthamstow, was summoned for "occupying the farm as a slaughterhouse for cattle," not being the holder of a licence under the Slaughterhouse Order, 1918. There were also 24 summonses in respect of slaughtering sheep not bought in a market, and of dealing in cattle without being licenced. Mr. Roland Oliver, who prosecuted, said the allegation was that defendant had consistently made illicit profits by dealing in sheep and cattle which he had bought privately and slaughtered. In three weeks he had supplied Taylors, Ltd., butchers, of Shaftesbury Avenue, W., with no fewer than 222 sheep and lambs and eleven bodies of beef. Interviewed by an official the defendant said, "I can see that the game is up." He added that he had made a good deal of money and was expecting to retire shortly. He was fined, with costs, £506 5s. in all. (*National Food Journal*, 13th August, 1919.)

MISCELLANEOUS NOTES.

France.—According to an official report, the condition of the crops on the 1st July was as follows (figures for July, 1918, in brackets):—

	Winter wheat, 57 (72); spring wheat, 49 (63);
Notes on Crop	rye, 64 (73); maize, 57 (62); winter barley,
Prospects Abroad.	63 (73); spring barley, 47 (59); winter oats,
	60 (68); spring oats, 45 (57); potatoes,
	62 (60). (<i>London Grain, Seed and Oil Reporter</i> , 21st August, 1919.)

Holland.—His Majesty's Consul-General at Rotterdam stated that in Holland apples and pears, on the whole, promised to be very satisfactory crops, while plums were moderate. *Apples.*—Conditions were excellent in the Bommelerwaard and the south part of Utrecht; very good in Gaasterland, Assen, the Betuwe and Tielerswaard; good to very good in Utrecht-Vleuten, Zeeland and South Limburg; good at Groningen, South Friesland, North Gelderland, de Beemster, Kennemerland and in South Holland; fairly good to good in the North Friesland, Leeuwarden, Overijssel and North Brabant; and fairly good at Veur Wassenaar and North Limburg. *Pears* were very good to excellent in the Bommelerwaard and the south part of Utrecht; good to very good in Zeeland; good in Groningen, Overijssel, Gelderland, the Betuwe, near Nymegen, Maas and Waal, Utrecht, West Utrecht, de Beemster, Kennemerland, South Holland and South Limburg; fairly good to good in Friesland and West Friesland; fairly good at Assen, North Brabant and North Limburg; and moderate in the Tielerswaard. *Plums.*—Good reports came from Assen, Oldenzaal, Upper Betuwe, Utrecht and Westland; fairly good from Eastern Groningen, Deventer, De Lymers, Gelderland, near Nymegen, Maas and Waal; and bad or moderate from other districts. *Grapes under glass* were good in all districts and sometimes very good. *Tomatoes* were good in most parts of the country. *Onions* were reported as good to very good from Gonda; moderate to fairly good from Utrecht, Westland, North Brabant and Limburg, and rather bad from South-Eastern Friesland, but in other districts the reports range from fairly good to good. *Potatoes.*—The prospects were fairly good to good; in North Holland, South Holland and Zeeland conditions were fairly good.

The areas under certain crops this year were given as follows, in acres (with figure for 1918 in brackets) :—Onions, 5,683 (6,466) ; potatoes, 425,282 (405,110) ; beans, 101,349 (115,480) ; and peas, 79,909 (86,687).

Sweden.—According to the official report issued at Stockholm on the 15th August, the crop outturn this year will be above the average, although owing to the fall of heavy rains during the harvest the quality will not reach the standard anticipated. A record crop of oats is forecasted, but the export of this grain is still prohibited. The condition of the crops on 31st July was as follows, corresponding figures for last year being given in brackets (5 = very good, 4 = good, 3 = average) :—Wheat, 3·5 (3·0) ; rye, 3·2 (3·0) ; barley, 3·5 (3·1) ; oats, 3·6 (3·1) ; mixed corn, 3·7 (3·1) ; hay, 3·3 (2·4) ; and potatoes, 3·5 (3·5). (*Broomhall's Corn Trade News*, 21st August, 1919.)

Italy.—The wheat crop in Italy this year is estimated at 19,300,000 qr. as compared with 22,000,000 qr. last year. (*Broomhall's Corn Trade News*, 4th September, 1919.)

Canada.—According to a bulletin issued by the Bureau of Statistics the areas under the crops this year were estimated on 30th June to be as follows (in acres, and figures for 1918 in brackets) :—All wheat, 17,282,570 (17,353,902) ; spring wheat, 16,484,820 (16,937,287) ; oats, 14,754,150 (14,700,000) ; barley, 3,017,920 (3,153,711) ; rye, 565,275 (555,294) ; peas, 213,283 (235,976) ; mixed grain, 886,650 (921,326) ; hay and clover, 10,662,870 (10,544,625) ; alfalfa, 196,793 (196,128) ; buckwheat, 535,225 (548,097) ; linseed, 1,069,330 (1,068,120) ; corn for husking, 239,050 (250,000) ; beans, 166,066 (228,577) ; potatoes, 712,665 (735,192) ; turnips, etc., 330,935 (343,037) ; corn for fodder, 487,115 (502,069). (*London Grain, Seed and Oil Reporter*, 23rd August, 1919.)

United States.—The Crop Reporting Board of the United States Department of Agriculture give the following estimates of production based on the condition of the crops on 1st September (in bush. and final official returns for 1918 in brackets) :—Winter wheat, 715,000,000 (558,449,000) ; spring wheat, 208,000,000 (358,651,000) ; all wheat, 923,000,000 (917,100,000) ; maize, 2,858,000,000 (2,582,814,000) ; oats, 1,225,000,000 (1,538,359,000) ; barley, 195,000,000 (256,375,000) ; rye, 85,000,000 (89,103,000) ; and linseed, 10,000,000 (14,657,000).

The average yield per acre compared with that of 1918 (in brackets) is as follows (in bush.) :—Winter wheat, 14·6 (15·2) ; Spring wheat, 9·2 (16·0) ; all wheat, 12·9 (15·5) ; maize, 27·8 (24·0) ; oats, 28·9 (34·6) ; barley, 21·9 (26·5) ; rye, 12·9 (14·4) ; and linseed, 5·5 (7·6). (*London Grain, Seed and Oil Reporter*, 8th September, 1919.)

South Africa.—The maize crop for the Union, based on the condition of the crop at the end of June, is estimated at 3,366,000 qr. as compared with 3,672,000 qr. last year. The acreage under the crop is estimated to be 11 per cent. less than last year. (*London Grain, Seed and Oil Reporter*, 1st September, 1919.)

India.—The final official estimate gives the total yield of wheat in India in 1919 as 35,259,000 qr. (*Broomhall's Corn Trade News*, 25th August, 1919.)

THE warm and dry weather during the early part of August was very favourable to the harvesting of the crops, and much corn was cut and secured in good condition. The wet weather at the end of the month delayed the work, but has not done much damage to the corn.

**Agricultural
Conditions in England
and Wales**

on 1st September.

There has been some slight improvement in the general condition of the corn crops during the month, but all are below the average. Wheat is the best of the three cereals, but is some 8 per cent. lighter than usual. Barley has slightly improved, but the yield is expected to be some 13 per cent. below the normal, while oats have gone back, and are the worst of the cereals, being more than 20 per cent. under average. All crops are short in the straw. Much progress has been made with the cutting and carting of wheat and oats, but that of barley is not so advanced. Beans have fallen off a little during the month, while peas have somewhat improved.

Potatoes have also slightly improved with the recent rains, and the plant is healthy, very few reports of disease being received, but the yield on the whole will be lighter than usual, about 9 per cent. below the average.

Although the root crops have benefited by the rain, there has not been sufficient moisture to overcome the serious effects of the earlier drought. Turnips and swedes, as also mangolds, are backward and irregular in plant, and the yield of all roots is likely to be about 20 per cent. less than usual.

Hops were not adversely affected by the dry weather at the beginning of the month, and the late rain was of assistance in checking the attacks of red spider which were beginning to prove troublesome. The yield is expected to be well over the average in the great hop-growing districts.

Orchard fruit has ripened well, and apples are over-average crops, pears about average, but plums are not so plentiful as usual.

Pastures are generally reported bare, but showing some improvement with the rain. Stock on the whole are healthy, but only in fair condition.

The supply of general labour has been sufficient to meet the ordinary requirements, but a shortage of skilled hands is still noticeable.

Summarising the returns, and expressing an average crop by 100, the appearance of the crops on the 1st September indicated probable yields which may be expressed by the following percentages :—Wheat, 92 ; barley, 87 ; oats, 78 ; beans, 90 ; peas, 91 ; potatoes, 91 ; turnips and swedes, 79 ; mangolds, 78 ; hops, 106.

The following local summaries give details regarding agricultural labour in the different districts of England and Wales :—

Agricultural Labour in England and Wales during August. *Northumberland, Durham, Cumberland, and Westmorland.*—Local shortages of skilled men are reported, but on the whole the supply of labour for harvesting is about sufficient for requirements.

Lancashire and Cheshire.—In a few districts the supply of labour is somewhat deficient, but in most it is about equal to requirements.

Yorkshire.—Skilled labour is scarce. In general there appears to be no serious deficiency for harvest work. Local conditions are, however, variable.

Shropshire and Stafford.—The supply of labour is sufficient for requirements in most districts, but in some parts there is still a deficiency of both temporary and skilled hands, the latter being particularly scarce.

Derby, Nottingham, Leicester, and Rutland.—Labour still appears to be scarce, but the supply is improving.

Lincoln and Norfolk.—Labour is fairly plentiful, though skilled men are still in short supply. Casual labourers are asking high wages.

Suffolk, Cambridge, and Huntingdon.—The supply of labour is sufficient in most districts, but there is still mention of a deficiency of skilled men in some parts.

Bedford, Northampton, and Warwick.—Labour on the whole is sufficient.

Buckingham, Oxford, and Berkshire.—There is generally no shortage of labour, but a larger supply of skilled hands would be welcome in some parts of the district.

Worcester, Hereford, and Gloucester.—The supply of labour is usually satisfactory, though there is still some scarcity of skilled men.

Cornwall, Devon, and Somerset.—Labour is generally sufficient in quantity, though the quality is not good, and the shortage of skilled men is still felt.

Dorset, Wiltshire, and Hampshire.—The supply of labour is generally sufficient, and sometimes fairly plentiful.

Surrey, Kent, and Sussex.—There is no general shortage of labour, though skilled hands seem to be required everywhere. Up to the present there has been plenty of labour for hop-picking.

Essex, Hertford, and Middlesex.—In most districts the supply of both skilled and casual labour is sufficient to meet the demand.

North Wales.—The supply of labour is about sufficient for requirements, though skilled men are scarce, and there is some scarcity of temporary labour.

Mid Wales.—Labour conditions vary considerably in different localities. Temporary and skilled labour is still deficient.

South Wales.—The supply of labour is short in most districts, particularly in Pembroke, but in some parts of Monmouth and Glamorgan there is sufficient for requirements.

AVERAGE PRICES of British Wheat, Barley, and Oats at certain Markets during the Month of August, 1917, 1918, and 1919.

	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919.	1917.	1918.	1919.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	78 2	76 2	75 11	64 1	...	73 11	55 7	59 5	64 2
Norwich ...	77 11	75 2	73 6	64 9	57 0	...	54 9	59 0	56 9
Peterborough	77 11	74 8	73 3	65 11	56 6	...	55 3	55 10	57 0
Lincoln ...	78 0	74 3	73 9	...	...	...	...	...	62 3
Doncaster ...	78 0	74 5	72 10	...	...	62 6	54 11	...	48 3
Salisbury ...	78 1	74 0	73 0	72 4	58 1	76 10	55 0	45 1	57 11

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1917, 1918 and 1919.

Weeks ended (in 1919).	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919.	1917.	1918.	1919.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Jan. 4...	76 0	71 2	72 2	66 4	58 0	62 3	47 1	45 5	48 8
" 11...	75 8	71 2	72 6	65 7	58 2	62 5	47 2	46 9	49 8
" 18...	75 8	71 3	72 7	64 9	58 1	62 3	47 4	47 9	50 0
" 25...	75 10	71 1	72 7	64 5	58 7	61 10	47 8	48 2	49 6
Feb. 1...	75 10	71 2	72 8	64 0	58 10	62 4	47 3	50 2	49 7
" 8...	76 0	72 0	72 7	63 5	59 0	62 3	46 11	50 6	49 2
" 15...	76 3	72 3	72 8	63 8	58 11	62 5	47 3	52 0	49 0
" 22...	76 9	72 2	72 8	63 9	58 9	62 6	47 8	52 3	49 4
Mar. 1...	77 4	72 2	72 7	64 0	57 9	62 7	48 0	52 0	48 8
" 8...	77 0	72 3	72 6	63 7	58 5	62 7	48 7	52 2	48 6
" 15...	78 10	72 4	72 5	64 1	56 10	62 5	49 4	51 0	46 8
" 22...	80 3	72 3	72 7	65 6	56 9	62 1	50 4	50 3	46 4
" 29...	81 5	72 4	72 7	71 10	56 7	62 8	51 10	48 10	46 11
Apl. 5...	84 4	72 11	72 6	69 11	56 7	62 8	55 1	49 10	47 2
" 12...	85 2	73 3	73 0	71 10	56 6	62 9	57 2	47 2	47 1
" 19...	84 10	73 3	73 1	70 6	56 6	62 9	59 8	47 0	47 3
" 26...	81 1	73 3	73 1	69 5	56 10	62 9	58 6	46 8	48 1
May 3...	77 7	73 5	73 2	64 4	56 5	62 8	54 9	47 4	48 7
" 10...	78 0	73 5	73 2	64 11	56 6	63 1	55 2	47 6	47 5
" 17...	77 11	73 4	73 3	64 10	56 6	62 4	55 2	46 4	47 11
" 24...	78 0	73 3	73 2	64 9	56 6	62 7	54 11	47 8	47 11
" 31...	78 0	73 8	73 3	65 11	60 0	62 7	54 11	44 9	48 3
June 7...	78 0	73 11	73 2	67 7	59 2	62 6	55 0	45 5	47 10
" 14...	78 2	74 3	73 3	75 6	57 9	62 8	55 1	45 7	48 11
" 21...	78 1	74 4	73 3	75 0	58 5	62 8	55 2	47 8	48 7
" 28...	78 3	74 4	73 3	73 11	57 10	63 4	55 1	46 4	49 1
July 5...	78 1	74 4	73 4	69 5	61 7	62 4	55 2	46 10	49 0
" 12...	78 2	74 4	73 3	70 10	57 5	63 1	55 1	47 0	49 11
" 19...	78 3	74 3	73 4	72 1	60 5	62 9	55 2	45 4	49 11
" 26...	78 3	74 3	73 4	65 7	56 11	63 4	55 2	46 2	48 11
Aug. 2...	78 2	74 3	73 3	73 6	57 1	62 10	55 0	45 10	50 3
" 9...	78 4	74 7	73 4	76 1	57 7	73 8	55 0	46 3	55 6
" 16...	78 7	74 2	73 3	68 11	61 4	75 2	55 6	55 11	61 4
" 23...	76 7	74 8	73 10	70 7	62 6	83 4	54 7	56 9	62 0
" 30...	72 1	74 8	73 3	60 4	60 1	86 7	49 0	57 11	61 10
Sept. 6...	71 6	72 3	73 4	59 3	60 4	89 3	46 7	56 9	61 1
" 13...	70 7	72 5		57 2	60 1		45 0	49 2	
" 20...	70 8	72 6		56 10	60 4		45 8	49 11	
" 27...	70 6	72 7		58 5	60 3		44 7	50 3	
Oct. 4...	70 8	72 8		57 9	60 3		44 9	50 9	
" 11...	71 0	72 6		58 5	60 3		44 5	51 6	
" 18...	70 8	72 7		59 3	60 3		44 1	50 9	
" 25...	70 10	72 5		60 1	60 3		43 0	50 5	
Nov. 1...	70 4	72 4		59 11	60 3		42 4	50 8	
" 8...	70 3	72 4		60 2	60 3		42 11	49 11	
" 15...	70 3	72 5		60 2	60 3		43 0	49 10	
" 22...	70 2	72 4		59 9	60 10		43 1	51 1	
" 29...	70 2	72 3		59 3	62 2		44 6	50 4	
Dec. 6...	70 7	72 4		58 7	62 6		43 5	51 4	
" 13...	71 2	72 3		58 0	62 7		43 6	51 4	
" 20...	71 1	72 4		57 7	62 3		44 2	50 5	
" 27...	71 1	72 3		57 7	62 3		44 10	50 6	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in August and July, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	AUGUST.		JULY.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
FAT STOCK :—	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	79 3	74 2	82 6	78 0
Herefords	78 7	73 10	82 3	76 11
Shorthorns	78 7	73 10	82 0	77 1
Devons	78 4	73 5	82 5	77 4
Welsh Runts	78 0	74 6	80 9	76 6
Fat Cows	73 9	65 9	77 1	69 0
	First Quality. per lb.*	Second Quality. per lb.*	First Quality. per lb.*	Second Quality. per lb.*
	d.	d.	d.	d.
Veal Calves	10½	9	16½	13½
Sheep :—				
Downs	14½	14½	14½	14½
Longwools	14½	14½	14½	14½
Cheviots	14½	14½	14½	14½
Blackfaced	14½	14½	14½	14½
Welsh	14½	14½	14½	14½
Cross-breds	14½	14½	14½	14½
	per score. live weight.	per score. live weight.	per score. live weight.	per score. live weight.
	s. d.	s. d.	s. d.	s. d.
Pigs :—				
Bacon Pigs	21 0	21 0	21 0	21 0
Porkers	21 0	21 0	21 0	21 0
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	50 12	36 15	50 13	37 7
„ —Calvers ...	47 15	36 2	47 10	36 10
Other Breeds—In Milk ...	45 13	32 2	44 11	33 19
„ —Calvers ...	29 10	27 0	31 0	29 10
Calves for Rearing	3 9	2 10	4 2	3 5
Store Cattle :—				
Shorthorns—Yearlings ...	15 17	13 0	16 15	13 10
„ —Two-year-olds...	26 6	21 15	27 5	22 6
„ —Three-year-olds	34 15	30 4	35 10	31 9
Herefords—Two-year-olds...	26 0	22 15	27 0	21 10
Devons—	28 1	22 11	29 6	23 13
Welsh Runts—	—	—	25 0	—
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	61 7	48 8	59 1	50 4
Store Pigs :—				
8 to 12 weeks old	60 11	44 11	67 5	50 7
12 to 16 „ „	98 8	79 11	102 9	81 5

* Estimated carcass weight.

NOTE.—The prices per lb for sheep do not include the value of the skins or pelts, which during August made prices equivalent to an additional 1½d. per lb. of the carcass weight for Downs, Longwools, Cheviots and Cross-breds, and 1½d. for Cheviots, and during July, 1½d. per lb. for Downs, Longwools, Cheviots and Cross-breds, and 1½d. for Blackfaced and Welsh.

In addition to the price quoted above for sheep per lb., sellers were entitled, under the Live Stock (Sales) Order, 1918, to charge an extra amount ranging from ss. to 6s. 6d. per head during July, according to the weight of the sheep.

**AVERAGE PRICES of PROVISIONS, POTATOES and HAY at
certain MARKETS in ENGLAND in August, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER :—	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.
British	—	—	—	—	27 6	—
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
„ Factory	—	—	—	—	—	—
Imported (Controlled)	252 0	—	252 0	—	252 0	—
CHEESE :—						
British—						
Cheddar	144 6	—	—	—	144 6	—
Cheshire	—	—	120 lb. 155 0	—	120 lb. 155 0	—
Canadian	144 6	—	per cwt. 144 6	—	per cwt. 144 6	—
BACON :—						
Irish (Green)	195 6	—	195 6	—	195 6	—
Canadian (Green sides)	208 0	203 0	208 0	202 0	204 0	200 0
HAMS :—						
York (Dried or Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green) (long cut)	193 6	191 6	193 0	191 0	196 0	192 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	42 1	39 4
Irish	37 6	—	36 7	35 1	37 0	35 0
Danish	—	—	—	—	40 3	37 3
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Early Eclipse	250 0	215 0	—	—	205 0	175 0
White Kidney	231 6	211 6	310 0	270 0	210 0	181 6
Other First Earlys ...	246 6	230 0	280 0	220 0	170 0	145 0
HAY :—						
Clover	—	—	—	—	—	—
Meadow	—	—	—	—	—	—

**AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in August, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.				Quality.	Birming- ham.	Leeds.	Liver- pool.	London.	Man- chester.
					per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—									
English	...	...	...	1st	119 0	119 0	—	119 0	119 0
				2nd	119 0	119 0	—	119 0	119 0
Cow and Bull	...	...	...	1st	119 0	119 0	119 0	119 0	119 0
				2nd	119 0	119 0	100 6	105 0	100 6
Irish : Port Killed	...	...	...	1st	119 0	—	119 0	119 0	—
				2nd	119 0	—	119 0	119 0	—
Argentine Frozen—									
Hind Quarters	...	...	...	1st	111 0	111 0	111 0	111 0	111 0
Fore "	...	...	...	1st	71 0	71 0	71 0	71 0	71 0
Argentine Chilled —									
Hind Quarters	...	...	...	1st	—	—	—	111 0	111 0
Fore "	...	...	...	1st	—	—	—	71 0	71 0
Brazilian Frozen —									
Hind Quarters	...	...	...	1st	104 6	104 0	—	104 0	—
Fore "	...	...	...	1st	65 0	64 0	—	64 0	—
VEAL :—									
British	...	...	...	1st	70 0	—	—	74 6	81 6
				2nd	—	81 6	—	56 0	74 6
MUTTON :—									
Scotch	...	...	...	1st	126 0	126 0	126 0	126 0	126 0
				2nd	126 0	126 0	126 0	126 0	126 0
English	...	...	...	1st	126 0	126 0	—	126 0	126 0
				2nd	126 0	126 0	—	126 0	126 0
Irish : Port Killed	...	...	...	1st	—	—	—	—	—
				2nd	—	—	—	—	—
Argentine Frozen	...	...	...	1st	98 0	98 0	98 0	98 0	98 0
New Zealand "	...	...	...	1st	—	—	—	98 0	98 0
Australian "	...	...	...	1st	—	—	—	98 0	98 0
LAMB :—									
British	...	...	...	1st	126 0	126 0	126 0	126 0	126 0
				2nd	126 0	126 0	126 0	126 0	126 0
New Zealand	...	...	...	1st	98 0	98 0	98 0	98 0	98 0
Australian...	...	...	...	1st	—	—	—	98 0	98 0
Argentine...	...	...	...	1st	98 0	98 0	98 0	98 0	98 0
PORK :—									
British	...	...	...	1st	—	—	149 6	149 6	149 6
				2nd	—	—	—	—	—
Frozen	...	...	...	1st	—	—	—	—	—

DISEASES OF ANIMALS ACTS 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	AUGUST.		EIGHT MONTHS ENDED AUGUST.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	21	21	136	176
Animals attacked	23	28	174	202
Foot-and-Mouth Disease :—				
Outbreaks	6	—	25	—
Animals attacked	522	—	1,555	—
Glanders (including Farcy) :—				
Outbreaks	4	—	19	23
Animals attacked	5	1	46	65
Parasitic Mange :—				
Outbreaks	272	220	4,059	3,449
Animals attacked	783	386	8,196	6,532
Rabies :—				
Number of cases	17	—	142	—
„ „ Dogs affected	17	—	139	—
„ „ other animals affected	—	—	3	—
Sheep-scab :—				
Outbreaks	2	6	220	252
Swine Fever :—				
Outbreaks	246	119	1,542	995
Swine slaughtered as diseased or exposed to infection ...	123	55	687	401

IRELAND.*(From the Returns of the Department of Agriculture and Technical
Instruction for Ireland.)*

DISEASE.	AUGUST.		EIGHT MONTHS ENDED AUGUST.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	—	—	—	2
Animals attacked	—	—	—	2
Glanders (including Farcy) :—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Parasitic Mange :—				
Outbreaks	11	6	123	87
Sheep-scab :—				
Outbreaks	14	21	172	203
Swine Fever :—				
Outbreaks	5	3	25	17
Swine slaughtered as diseased or exposed to infection ...	11	10	74	58

The Weather in England during August.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours
<i>Week ending 2nd Aug.:</i>								
England, N.E. ...	56·8	-2·5	0·11	3	-10	2	4·3	-1·6
England, E. ...	58·9	-3·0	0·09	2	-8	2	3·7	-3·0
Midland Counties ...	58·8	-1·2	0·07	2	-11	1	4·8	-1·1
England, S.E. ...	59·1	-2·3	0·05	1	-9	1	5·3	-1·6
England, N.W. ...	57·2	-1·9	0·32	8	-12	2	5·1	-0·7
England, S.W. ...	59·1	-0·7	0·06	1	-16	1	6·7	+0·2
English Channel ...	60·2	-1·4	0·05	1	-11	2	7·7	-0·7
<i>Week ending 9th Aug.:</i>								
England, N.E. ...	59·7	+1·0	0·17	4	-10	2	6·7	+1·2
England, E. ...	60·6	0·0	0·05	1	-11	1	7·8	+1·7
Midland Counties ...	60·9	+1·2	0·12	3	-10	1	7·6	+2·0
England, S.E. ...	61·5	0·0	0·05	1	-9	1	9·6	+3·0
England, N.W. ...	59·3	+0·5	0·17	4	-15	2	5·1	-0·3
England, S.W. ...	60·8	+0·7	0·12	3	-13	1	8·5	+2·3
English Channel ...	62·0	0·0	0·34	9	-5	1	9·1	+1·1
<i>Week ending 16th Aug.:</i>								
England, N.E. ...	63·6	+5·4	0·16	4	-11	2	8·8	+3·5
England, E. ...	65·4	+5·2	0·06	2	-10	1	10·5	+4·3
Midland Counties ...	65·4	+6·1	0·05	1	-13	1	9·8	+4·2
England, S.E. ...	66·5	+5·4	0·01	0	-13	0	10·9	+4·1
England, N.W. ...	62·0	+3·6	0·10	3	-16	1	8·0	+2·8
England, S.W. ...	64·7	+5·2	0·05	1	-17	1	9·5	+3·3
English Channel ...	65·4	+3·6	0·01	0	-14	1	10·8	+3·1
<i>Week ending 23rd Aug.:</i>								
England, N.E. ...	60·0	+2·3	0·67	17	0	5	5·1	+0·2
England, E. ...	62·7	+3·0	0·65	17	+3	4	5·6	0·0
Midland Counties ...	61·1	+2·5	0·87	22	+5	5	4·7	-0·5
England, S.E. ...	63·1	+2·7	0·33	8	-7	3	5·4	-0·8
England, N.W. ...	59·5	+1·4	1·00	25	+1	5	5·0	0·0
England, S.W. ...	61·8	+2·7	0·83	21	-1	4	5·3	-0·5
English Channel ...	64·2	+2·7	0·54	14	-2	3	6·7	-0·5
<i>Week ending 30th Aug.:</i>								
England, N.E. ...	53·2	-3·6	1·56	40	+25	4	3·6	-1·3
England, E. ...	56·1	-2·5	1·59	40	+26	5	3·8	-1·8
Midland Counties ...	51·3	-3·0	1·44	37	+20	6	3·6	-1·4
England, S.E. ...	58·4	-1·0	2·02	51	+34	6	4·6	-1·3
England, N.W. ...	52·8	-3·9	2·05	52	+29	6	3·6	-0·9
England, S.W. ...	57·6	-1·4	2·13	54	+30	7	3·6	-1·8
English Channel ...	60·6	0·0	1·98	50	+34	6	5·3	-1·2

1 inch = 25·4 millimetres.

THE JOURNAL OF THE BOARD OF AGRICULTURE

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EDITORIAL NOTES.

At p. 732 of this issue of the *Journal* will be found a message from the President of the Board to Agricultural Executive Committees. The still insistent need for increasing the output of home-grown food can be met by a combination of means. These include extension of arable farming, early ploughing and sowing of winter corn, increased use of manures, rapid and efficient harvesting, cleaner cultivation, better seed, destruction of pests (vermin, insects, fungi, weeds), and so forth. All such means, taken together, would tend to a general levelling up of the standard of farming to the methods of the best farmers. It is desirable that really incapable and negligent farmers should be crowded out or otherwise eliminated. Lord Lee desires that the County Committees shall take firm and even drastic action, within the powers granted by Parliament, "to deal with cases in which land is being badly or negligently farmed and to enforce on all occupiers the observance of the rules of good husbandry." Such action will be supported to the full by the Board and would be welcomed by the general public. To increase home-grown food supplies it is essential that all farmers should make the best possible use of the land which they occupy, and good farmers might well endeavour to exert a beneficial influence—if only by example—on their less modern and up-to-date neighbours.

* * * * *

THE tractor trials held at Lincoln from 24th to 27th September opened with fine weather, which held until the close, one or two storms excepted. It may be said that the trials could hardly have been held under more ideal conditions or have received more attention from farmers, who were present in their thousands and devoting themselves to a close comparison

**The Lincoln
Tractor Trials.**

of the competing machines and the results accomplished. Great eagerness was shown by farmers to come to a personal decision as to the tractor most suitable for their soil and local conditions, while many of them were concerned about adding a second tractor to one already at work on their farm. It appeared to be the general consensus of opinion that the majority of the tractors were doing quite good work, though there were undoubted differences between the results on the heavy land and cliff land respectively. It struck visitors, for example, that on the heavy land some tractors might possibly have done better work ploughing one furrow less, while on the lightest fields of the cliff land one furrow extra might have had better results by reducing the speed at which the outfit moved.

The great work done by tractors during the War has certainly had the effect of convincing farmers that they would do well to consider their position fully in relation to tractor work, as it was steadily becoming clear that tractors would enable work to be done rapidly in fine weather, would aid in securing harvest quickly and in good condition, and would ensure early autumn ploughing and consequent early sowing of winter grain—so saving seed and tending to larger yields. Such results would in themselves warrant every effort to make the tractor really efficient and reliable, but some types of tractor may also be used for road-haulage work, and for such general work as a stationary steam, gas, or oil engine has commonly performed, *e.g.*, chaff-cutting, root-pulping, wood-cutting, and even threshing. The Lincoln trials have been a great stimulus to the use of farm tractors, and another year or two will doubtless see tractors doing much of the routine tillage work of the country, as well as the other classes of power work mentioned above. A preliminary report on the trials, recording the impressions of certain officers of the Board who were present, will be found at p. 686. A more detailed account must await the publication of the Judge's report.

THE problem of land settlement is one which has confronted most European nations as a result of war conditions. In the

United Kingdom its importance was early realised, and during the War committees were appointed by the Government to consider the most suitable measures which should be taken to encourage soldiers and sailors to settle on the land after demobilisation. An official

scheme was ready immediately after the Armistice to give effect to the recommendations of these committees, and particulars have been published at various times in this *Journal*. The broad outlines of the working of this scheme and the progress which has been made are described in Mr. Floud's paper in this issue (p. 676), and the powers entrusted to the Boards of Agriculture and to the County Councils under the Land Settlement (Facilities) Act, 1919, are briefly explained in the note on p. 732.

In recent years it has become more and more recognised that book-keeping, as an aid to profitable farming, has not hitherto received attention to the extent it deserves.

Farm Book-keeping. In ordinary business management a knowledge of accounts has been regarded as indispensable, and there is every reason why a proper system of accounting would be of the greatest value to agriculture. By sound book-keeping the individual farmer is able to determine and compare the results of particular branches of farming. Such information could be made of wider application if book-keeping were to be more generally practised, and would be of benefit not only to the individuals concerned but to the general body of farmers. In the past, when individual experience, knowledge and energy in the practical operations of farm work were alone held sufficient to enable a reasonable profit to be made, book-keeping was possibly of less importance, but conditions have changed. With the rapidly extending use of agricultural machinery and other factors which promise to make for economy in the cost of production, profit and loss in particular methods of farming will have to be weighed more carefully, and in the case of expensive equipment, such as farm tractors, which depreciates rapidly, book-keeping is necessary in order that such loss of capital may be disclosed. Farmers are now beginning to consider what system of book-keeping is the most practicable and useful. The leaflet issued by the Agricultural Costings Committee on the value of farm book-keeping and cost accounting (reprinted at p. 708) is deserving of careful study. In conjunction with this article may be read the Board's Leaflet No. 240 on *Farm Book-keeping*.

LAND SETTLEMENT.

THE following is a report of an Address given to the Agricultural Club on 28th May by Mr. F. L. C. Floud, C.B. The figures have been corrected up to 6th September :—

The object of the Government Land Settlement policy is not only to satisfy the demand from ex-Service men for opportunities of settlement on the land for which they have fought, but also to secure an increase in the rural population and greater production from the land. It has been the universal experience after all great wars that many men on release from military service desire to settle on the land, and it would be a tragedy if no opportunities of doing so were available in the Mother Country and the men had no option but to emigrate to the Dominions or to foreign countries.

Any scheme of land settlement must be elastic in character in order to meet the varying needs of different classes of men. Some men will prefer paid employment on the land, others will only be satisfied with small holdings of their own, and others wish to begin in a small way with a cottage and an acre or two while obtaining the greater part of their livelihood as farm labourers. Some men have already all the necessary knowledge and experience of the cultivation of the land, others are men who, as a result of their military service, desire to take up agriculture for the first time and consequently require training. All these various classes must be provided for in different ways, and it is important that those who have to administer the scheme should bear in mind that they are dealing not with machines but with human beings, most of whom have definite ideas of what they want.

Employment.—With regard to employment on the land as distinct from the provision of small holdings, it is believed that any ex-Service men who were agricultural labourers before the War will be able to return to their former occupation, and that the farmers will be only too glad to re-engage them at the increased wages now payable. Owing to the increased area of land brought under cultivation during the War, and to the fact that many of those who went from the land into the Army have lost their lives, or have been disabled, there is a shortage of farm labour in some parts of the country. There are, therefore, openings for the employment in agriculture of men who before the War were engaged in other occupations, but who now desire to settle on the land, and such men will be wise if in the first instance they seek employment with a good farmer or

market gardener. The wages now current, coupled with the other advantages of country life, compare much more favourably with the conditions of industrial and urban employment than was the case before the War, and so far as financial returns are concerned an agricultural labourer in regular work will often be better off than he would be as a small holder cultivating his own land, while his hours of labour will be much shorter.

Training.—Farmers are usually reluctant to employ men who are totally unskilled in agricultural operations, and the Board have arranged, therefore, to provide short courses of training of from six to eight weeks in the manual operations of a farm. Any able-bodied ex-Service man who wishes to obtain work on the land can apply for such training to the Agricultural Executive Committee of his county, and during training he will be paid 30s. a week, less 17s. 6d. for his board and lodging. Married men and men with dependents may receive in addition a subsistence allowance of 2s. 6d. a day while at the training centre. At the conclusion of their training the Agricultural Executive Committee will assist in placing the men in employment with farmers, and it is believed that farmers will be ready to take such men and employ them at the district rate of wage. Ten training centres are already open, eight for general farming, one for tractor driving, and one for horticulture, and additional centres will be opened as soon as they are required. Up to the present, however, the demand has not been large, and only 627 men have entered the training centres, of whom 390 have completed their courses and obtained employment.*

The Board decided that it was not practicable to attempt to provide for able-bodied men the long and expensive course of training which would be necessary to fit unskilled men to become small holders, particularly as it would be impossible to find them holdings as soon as their training had been completed.

Disabled Men.—In the case, however, of men who are in receipt of disability pensions, the Government have undertaken to provide longer courses of training up to a year, and the responsibility of dealing with such men who desire to settle on the land has been transferred from the Ministry of Pensions to the Board of Agriculture. Two hundred and thirty-nine disabled men are at present in 14 training centres, and 176 have been placed for training with individual farmers. These men receive a personal allowance of 40s. per week, wife's allowance of 10s. per week, children's allowances of from 7s. 6d.

* It has now been decided that courses for training able-bodied men will not be provided after the 31st March, 1920.

to 6s. per week, and "living away from home" allowance in respect of dependents of from 17s. 6d. to 10s. 6d. per week. In addition, a comfort allowance up to 7s. 6d. a week may be awarded by the local War Pensions Committee.

Officers.—Special training schemes have been established for ex-officers and men of similar educational standard who desire to take up agriculture. A limited number, not exceeding 100, of scholarships up to £175 a year for three years, tenable at a university or agricultural college, are available for men who desire to become agricultural organisers or teachers of agriculture. Over 1,100 applications for these scholarships have been received by the Board, and 65 have been granted, and in view of the limited number of posts available it is not proposed to award more than 100 scholarships. The Board have also been authorised to give 2,000 allowances not exceeding £125 a year for two years to ex-officers who intend to start farming on their own account, to enable them to obtain residential training and practical experience with a good farmer. Over 3,200 applications have been received for these allowances, 1,200 ex-officers have commenced their training, and 211 more have been approved, and will start shortly. The number of allowances now available is very limited, and applications are confined to those officers and men who are demobilised between 1st September and 31st December, 1919. After the latter date no applications can be considered.

Settlement.—The responsibility of dealing with men who desire to settle on the land otherwise than as ordinary wage earners working for farmers or market gardeners is divided between the Board and the County Councils.

Farm Settlements.—The Board themselves were authorised by the Small Holdings (Colonies) Act, 1916, to acquire not more than 6,000 acres in England and Wales for the establishment of co-operative settlements on the lines recommended by the Verney Committee which reported in January (Cd. 8182). The whole area authorised was acquired in 1916 and 1917, and by the amending Act of 1918 the area authorised to be acquired was increased to 60,000 acres. Up to the present ten estates have been acquired, comprising 18,600 acres, and active negotiations are in progress for the acquisition of an additional 10,000 acres.

These settlements are being developed either as small holdings colonies or as big profit-sharing farms. In the latter case, as at Patrington in Yorkshire, the land is farmed as a whole by a Director, the settlers have their own cottages with

half an acre of garden, they are employed on the farm at the district rate of wage, and, after a preliminary period of probation, they are entitled to a share in the profits made from farming the land. The profits, after paying 5 per cent. interest on the farming capital and the working expenses of the farm, including rent, rates, repairs, and other annual charges, and after allocating a percentage to a reserve fund, are divided between capital, management, and labour in proportion to the amounts paid out to them in the working account. In other words the settlers receive dividends on the amount of their wages for the year. For the 18 months ended 30th September, 1918, a period which includes two harvests, the net profit on the Patrington Settlement of 2,300 acres was £11,685, and the share of profits due to the settlers amounted to a dividend of over 50 per cent. on their wages.

The other type of settlement may be illustrated by the one at Holbeach in Lincolnshire. Here the Board have leased from the Crown 1,000 acres of first-class agricultural land. It is specially suited for market garden small holdings, and it is being developed to provide some 70 small holdings of 5 acres each in the first instance, to be increased to 10 acres as the men find their feet. The remainder of the estate will be retained as a central farm under the control of the Director, whose advice and assistance will be available for the small holders both as regards the cultivation of their holdings and the co-operative organisation of facilities for the purchase of their requirements and the sale of their produce. The settlers will also be able to obtain on hire from the central farm the use of horses and the more expensive farm machinery, and will be able to supplement their earnings by working on the central farm at certain seasons. Fifty-four new cottages have been erected on this estate, and 10 more will be built. The cottages are let to the settlers at £10 a year, and they pay a rent of £2 10s. an acre for their land.

At the present time the total number of ex-Service settlers on the Board's Farm Settlements is 239, and additional men are being taken on each week.

County Council Small Holdings.—The bulk of the applications for small holdings are from men who were on the land before joining the Army, and it is the duty of each County Council to provide land for its own residents. A large part of the demand comes from men who want small areas of land near their own homes, and although the Board and the County Councils have been severely criticised for providing such accommodation

holdings there is a great deal to be said in their favour. There are many men in the villages whose principal occupation does not employ their whole time, such as carriers, postmen, butchers, carpenters, or even publicans, and the provision of a small area of land for cultivation or for the keeping of a few live stock often means to such men the difference between bare subsistence and a comfortable living.

There is a large demand also for self-supporting holdings of from 30 to 50 acres for mixed or dairy farms, and for smaller holdings for fruit growing and market gardening. In pre-war days these small holdings were very successful in suitable districts such as Huntingdon, Isle of Ely, South Lincoln, Cornwall, and Norfolk. All are agreed that the success of many of these men was amazing, and on visiting some of these districts one cannot but be struck by the general air of prosperity due to the facilities for men to get land.

Cottage Holdings.—A large number of men will be better off to begin with if they are provided with a cottage and a small area of land (2–5 acres), but obtain the principal part of their livelihood by working for others. These holdings will provide the first step on the ladder, and will be of great value by increasing the number of untied cottages. They will also add to the rural population and provide additional labour which will be available for the farmers. Cottage holdings are particularly suited to men suffering from disablement such as shell shock, tuberculosis, etc., who cannot go back to the towns, and whose only hope is a life in the country among healthy surroundings. They will have their pensions and may be able to earn a little extra and be able to live in fairly comfortable conditions.

Equipment and Buildings.—Equipment and buildings will have to be provided. Before the War only 700 cottages had been built by County Councils under the Small Holdings Act, but under present conditions it is evident that an enormous number of new cottages must be provided, and the County Councils must take their part in the work. They are badly needed for small holdings and also for the general interest of agriculture. Many existing cottages ought to be condemned, but until something can take their place they must be allowed to stand. It is hoped that the County Councils will embark on a vigorous policy of equipping adequately all the land they acquire for land settlement.

Business Organisation.—There is general agreement that co-operation is the secret of success in land settlement, but up

to the present there has not been much result from the efforts of the Agricultural Organisation Society. For small holders, conditions in the future are bound to be difficult. They may have to face a serious fall in prices, and they will not be able to compete with larger growers unless they combine on co-operative lines.

Transport.—One of the most important factors in the success of small holdings is adequate transport facilities for the conveyance to market of the small holder's produce. There is a great work to be done in improving rural transport, and we are hoping for great things from the new Ministry of Transport when it gets to work. We know that there is no part of the reconstruction policy of the Government in which the Prime Minister takes more interest than in the question of transport, and it is undoubtedly the case that many parts of the country will not be properly developed till the transport facilities are improved.

Capital.—It is essential that the small holder should be adequately equipped with capital. Big farmers often have not enough, and the production from the land would in many cases be greatly increased if farmers would concentrate their capital on smaller areas. Without sufficient capital the small holder cannot get good stock or implements, and will have no chance of a business success. The Government propose, therefore, to authorise advances of capital to approved applicants on the recommendation of the County Councils through the machinery of the Joint Stock Banks.

There is a different system in Germany and Denmark, but people often forget that in this country we have one great asset—the finest banking system in the world. The Government consider it is best to use the organisation of the Joint Stock Banks rather than try experiments in other directions. There is the additional advantage that it will encourage the small holder to open a banking account of his own, which is a step towards keeping farming accounts. If the small holder is prepared to go to the Bank and start an account, even with an overdraft guaranteed by the Board through the County Council, it will be better than attempting to force a credit system based on unlimited liability, which, however successful abroad where the conditions are different, has made no progress in this country, and is evidently alien to the type of men with whom we have to deal.

Rent.—One of the first questions the small holder will ask is: what will the rent be? Under the old Small Holdings Act the County Council paid for the land, equipment, etc.,

added a charge for management, and the rent had to be sufficient to recoup the whole of the annual charges. Under present conditions we have had to depart entirely from that method. The interest on loans is now $5\frac{1}{2}$ per cent. as compared to $3\frac{1}{2}$ per cent. before the War, which means an extra charge of £1 an acre for land which costs £50 an acre. Buildings cost anything from 100 per cent. to 200 per cent. more, and it is obviously impossible for the small holder to pay a rent which would recoup the whole of the capital outlay. The principle adopted is that the small holder shall pay a fair rent at present-day values fixed by the County Council according to the quality of the land.

Finance.—This side of the question is appalling. The Government have set aside £20,000,000 for loans in the next two years, and have undertaken to pay the whole of the annual deficiency during the next seven years, and at the end of that period to write off the difference between the cost and the then value of the small holdings.

On every cottage built there will be a heavy annual loss which may amount to 13s. a week, or even more, and if the whole of the £20,000,000 is spent the total net cost to the Exchequer might at the worst be as much as £8,000,000. It is not a cheering prospect for the taxpayer, but at any rate it can be regarded as evidence of Government recognition of the debt the country owes to the men who have fought in the War, and if agriculture remains prosperous the loss should be considerably less.

Progress made.—The demand from ex-Service men amounts at present to 19,300 applications for 349,000 acres, and the applications are increasing rapidly each week. Inquiries by a Commissioner through one army corps showed a percentage of between 4 and 5 who desired to settle on the land. If this percentage is constant throughout the whole Army there would be about 750,000 applicants for land, but the demand is not expected to be so great, and it would be physically impossible to provide small holdings in this country for such a number without dispossessing thousands of the existing tenants.

The average pre-war size of a holding was 13 acres. If we put the size of holdings at present applied for at 10–12 acres, at least 200,000 acres are already required.

The County Council returns show that out of 13,500 men interviewed, 11,700 have been approved as suitable. What prospect is there of supplying the present demand? The Board have acquired 24,500 acres, and the County Councils 88,500 acres, and are negotiating for a further 93,000 acres.

If all is acquired there will be not more than is sufficient to satisfy the present demand, and as soon as land is ready for occupation the number of applicants is sure to increase considerably. Compulsory orders have been made by County Councils in respect of 13,000 acres, where the owners were unwilling to sell, or would not agree as to the price.

Price of Land.—Newspapers have commented on the inflated prices which are being paid for land, and it is true that the value of good land has gone up 20 per cent. to 35 per cent. over pre-war prices. These prices had to be paid unless the Government adopted some other standard than market value of land as the basis for the acquisition of land for public purposes.

The Board realised the penalty of not doing anything during the War. They had pointed out that during the War they ought to begin to get land to provide for the after-war demand, but the Treasury felt unable to provide any money until it was certain that the War would be won. No doubt the Treasury were justified in their attitude, but the result was that much higher prices had to be paid now than would have been the case two or three years ago.

Answers to some Criticisms.—It is said by many of the applicants that promises were made by the Government that facilities would be given for land settlement, but that when it comes to the point they are told that they must wait 18 months. The reason of the delay is—and it is not sufficiently recognised—that all the land is already occupied by someone. I have been astonished by newspaper writers who think that there is any amount of derelict land available admirably suited for small holdings. Of course, it does not exist, and all suitable land is at present occupied by someone. The occupier is entitled to notice or heavy compensation for early possession. There is bound to be some delay before vacant possession can be obtained, but the Land Settlement Act contains special provisions which will reduce this delay to the minimum. Even when vacant possession has been obtained, it takes some time before the necessary houses and buildings can be erected. The difficulties of building at present, with the high cost of materials and the shortage of skilled labour, are so serious that suggestions are often made that disused army huts should be made available as a temporary expedient. The Board and the County Councils are doing this to some extent, but it is not a satisfactory solution. The huts are being sold at auction, and are fetching high prices, and by the time they have been removed, re-erected, divided, and made fit for habitation, they

cost anything from £400 to £500 each. The loan charges on the cost, having regard to the comparatively short period of their life, would be as much or more than the rent of a permanent cottage, and, moreover, we do not want to disfigure the countryside by putting up numbers of old army huts as suitable homes for heroes.

Another criticism is directed against the choice of the County Councils as the agents to carry out the work of land settlement, and we are often told that most of the Councils are composed of landowners and farmers, and are reactionary bodies. In the opinion of the Board this criticism is not justified, but it must be met by the Councils showing themselves in earnest and really sympathetic to the applicants. The majority of the Councils are sympathetic and are working hard; but it would be wise for the County Councils to recognise the prejudice against them.

There is a very strong case for the County Councils carrying out the work of land settlement. They are the bodies in possession and the only bodies with the necessary statutory powers. The only alternative possible was a bureaucratic system working directly under the Board, and the last thing the country wants is a vast increase in the number of Government officials.

Other kinds of criticism come from some of the farmers, who believe that an extension of small holdings will result in reduced production from the land. The question of the best economic unit for production is a highly controversial one on which different opinions may legitimately be held. It has, however, been the experience of the Board that the land which was converted into small holdings before the War is in fact producing more and carrying a larger head of stock than was the case before it was taken over. It is probably true that the land taken had not been very highly farmed when it was in large occupations, but until all the large farms of the country are producing up to the maximum there is plenty of room for a large extension of small holdings, not only without any loss of production but with every hope of gain. There is no doubt also that men will work much harder for themselves than they will for other people, and as a general rule there is less waste and more attention to side lines on small holdings than on large farms. Moreover, apart from the question of what is the most productive unit, there are other important advantages of small holdings from the social and political points of view. It is a striking feature of the modern labour movement that more importance is attached to free and full conditions of life than

to the mere monetary returns of labour. Man does not live by bread alone, and an independent career and an escape from the factory system of industrial employment is worth more to many men than highly-paid service for others.

Farmers are also critical of the scheme on the ground that it will involve great hardship to sitting tenants. The Board are anxious to avoid any undue displacement of good farmers, and wherever possible land will be taken on the expiration of tenancies or from men who occupy several farms. But it must be recognised that the demand for small holdings is very large, that the Government have given definite pledges to suitable ex-Service men that land will be provided for them, and that there will be serious trouble if these pledges are not carried out. There is a great deal of land in the country which is not producing at present more than half of what it should, and there are many cases where it would be in the national interests to reduce the holdings of men who have larger farms than they have the capital to farm properly. In their own interests farmers would be very ill advised to take up an attitude of opposition to land settlement, as it will help to increase the reserve of labour available for their assistance at busy seasons. A considerable area of land has been offered to the Board or to County Councils by some of the largest occupying owners who realise this. (Owing to the action of the Wages Board, the farmer's labour bill has increased very considerably, and it is probable that in the future farmers will not be able to afford to keep such a large staff of regular labourers as formerly, and that they will have to rely more on casual labour, for which small holdings form an excellent recruiting ground.

The Board recognise fully the great difficulties of the task for which they are responsible, but with reasonable patience on the part of the men and hearty co-operation from County Councils, landowners and farmers, it can be carried out with great advantage to the interests of the nation as a whole, and without any harm to agriculture or food production. I feel sure that in this work the Board can rely on the sympathetic assistance of all members of the Agricultural Wages Board, whether they belong to the workers' or to the employers' side.

THE LINCOLN TRACTOR TRIALS.

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H. G. RICHARDSON, M.A., B.Sc.

Preliminary Notice.

THE Lincoln Tractor Trials mark a definite stage in the employment of the internal combustion engine in British farming. A detailed account must necessarily await the Judges' report, which at the time of writing has not been issued, but the present opportunity may be taken for dealing generally with the lessons conveyed by the trials.

Two facts must strike any observer: with insignificant exceptions, all the competing tractors ran practically continuously and without a hitch; the very large attendance was composed of farmers and others from all parts of the United Kingdom and abroad, all present not as spectators but to obtain practical information as users, manufacturers or officials. The contrast in the circumstances of the trials as well as in the size and attitude of the gathering with what might be seen four or five, or even fewer, years ago, reflects not only upon the Society of Motor Manufacturers and Traders who organised the exhibition, but upon the Board of Agriculture, without whose activities, it may be asserted, the country would still have been in the pioneer stage.

Types of Tractor exhibited.—Of the thirty or so models which the Food Production Department of the Board purchased at the commencement of the Tractor Scheme early in 1917, practically none was competing except such as had been found by the Department to be suited to British conditions. The unsuitable models have disappeared from the British market, superior models by the same manufacturers in some cases taking their place. This process would have occurred in any event, but without the intervention of the Government Tractor Scheme, the process would inevitably have been spread over a considerable period, instead of little more than two years. Manufacturers have undoubtedly learned from the experience of the Department, both from the machines that proved successful and were introduced in great numbers, and also from the larger number of types that failed and were represented by at most a few hundred machines in all.

The pioneer stage of the industry having been passed, it was to be expected that there would be few novel features in the machines competing. The present tendency of manufacturers is the sound one of developing on lines well-established

by experience in this country, improving where necessary in detail, although it is at the same time evident that all manufacturers probably realise that great, and perhaps fundamental, changes may be introduced before long in the design of agricultural tractors and will be willing to follow a lead which has a substantial promise of success.

One noteworthy feature at the trials was the evidence afforded by the types exhibited that manufacturers have definitely departed from the idea that great weight is necessary and are paying close attention to the reduction of weight. Beyond a certain point any increase of weight must clearly increase the liability of slipping on soft ground and decrease the ability of the tractor to climb gradients, besides increasing the risk of damage to the engine when stones are encountered. Considerable attention has also clearly been given to rendering the vital parts of the machinery more accessible, and to providing protection from the effect of weather and dirt.

High-speed versus Low-speed.—At present one of the most interesting aspects of the industry is the contest between the high-speed vertical engine (adapted primarily for petrol) and the low-speed horizontal engine (adapted primarily for paraffin). This is particularly illustrated by the exhibits of the International Harvester Company, who have introduced the "International Junior," a four-cylinder high-speed engine rated at 22.5 h.p. side by side with the well-known Titan and Mogul, both slow-speed horizontal engines. Excellent work is performed by both types of machine, although there is a tendency to criticise adversely some of the ploughing done by machines of the type of the "International Junior," "Fordson," and "Austin," and others fitted with high-speed vertical engines, all of which develop a higher ploughing speed than machines with the horizontal oil engine. The criticism is based upon the fact that the breasts of tractor ploughs are still designed on the lines of the horse-plough breasts, the construction of which was determined by the speed of a team of horses moving at the rate of about two miles an hour: with a higher speed there is a tendency for the furrow slice to be broken and to be cast farther than is desired in good ploughing. The solution of the problem is, however, not to reduce the speed of the tractor (and so to increase the cost of the work) but to modify the design of the breast. Taking the work as a whole there is probably little to choose between the two types, and the comparative value of the two under present conditions is likely to be best shown by their respective durability, wearing qualities and ease in handling.

Wheels and Caterpillar Track. Another problem of a similar character is presented by the use, in a minority of the types exhibited, of caterpillar tracks. All these machines were employing high-speed vertical engines: the caterpillar tractors were principally of British manufacture (Blackstone, Clayton, Martin), only one (the Cleveland) coming from America. Certain of the British manufacturers were exhibiting both wheeled and caterpillar types, a sure sign that the question is still in doubt. It is dubious whether there is any advantage in the caterpillar type, at least in its present stage of development, to outweigh the disadvantages which result from an increase in the number of wearing parts. The theoretical principles underlying the employment of the caterpillar track are that in this way the actual dead weight is distributed, thus reducing the intensity of pressure upon the land, while the factor of adhesion is increased. While the former principle is undoubtedly true, it is by no means certain that the pressure exerted by the wheeled tractors ordinarily in use has any adverse effect upon tillage; at the same time it was not evident at the trials, nor has it been shown in farming practice, that any superior grip on the land has been secured by caterpillar tracks as compared with wheels fitted with suitable attachments. It may be remarked that many various devices were used at the trials to give wheeled tractors the necessary grip on the land. These may be classified in three groups: spikes, bars and spuds; but no particular type appeared to act more efficiently than another, and the question is complicated by the different sizes and designs employed for each type.

In making a comparison with wheeled tractors it is not suggested that excellent work is not performed by caterpillar tractors, but that their advantages do not lie in their distinguishing feature.

Self-contained Machines.—The self-contained machine has been taken up only by a minority of manufacturers. At the Lincoln Trials were to be seen the Crawley Agrimotor, the Moline (both wheeled tractors) and the Martin Caterpillar. The theoretical advantages of the self-contained machine lie in the smaller headland which, it is supposed, will be left, and the fact that the operator sits behind his work and can thus better observe and adjust the plough or other implement attached. Some of the spectators present at the trials were also of opinion that the implement was kept steadier by the weight of the operator above it. The single-unit machines also occupy less time in turning, being in many cases able to come out, turn and

re-enter without any stoppage or slackening of speed ; apart from this factor it was not apparent that any marked advantage lay in the special features of the self-contained machines. Independent tractors were turning on headlands as narrow, and the operators seemed to experience no difficulty in watching and regulating their work. The problem is one to which time and attention are likely to be devoted in future and to which no final answer is yet possible.

Road Work.—A most significant feature of the trials lay in the haulage tests. No figures are yet available showing the performance of individual machines, but some excellent work was undoubtedly performed. The great difficulty previously experienced has been to prevent excessive vibration in agricultural tractors when used upon the road, since, with very few exceptions, they are only sprung on the front axle. It remains to be seen whether the machines can stand the work. The device which has been adopted in the case of the "Austin" of fastening rubber blocks to the rear wheels appears to be promising. Further developments in the adaptation of agricultural tractors to road haulage will be awaited with interest, since a device which will render the machines equally suitable for field and road work will double their value to the farmer.

Ploughing and Types of Plough.—The work which was done with various types of ploughs at the trials should settle once for all the controversy which has continued for some years as to the suitability of American ploughs for use in this country. As was stated in a previous article,* American firms made a mistake in introducing ploughs with wide furrows and digger breasts which naturally could not turn out work at all comparable with that performed by an English general-purpose plough. All the ploughs operated at the Lincoln trials were turning narrow furrows and were fitted with general-purpose breasts approximating to British pattern. The result was such that it would be very difficult, if not impossible, for any person ignorant of the type used to distinguish in most instances between the work of British and American ploughs. On the light (heath) land indeed the American ploughs appeared to scour better and did on the whole the neater work.

Another feature of the ploughing was the general adoption of self-lift ploughs. Riding ploughs were in use with a few of the heavier tractors, but no advantage could be perceived to arise from the extra labour employed.

Threshing.—A number of exhibitions of threshing by tractor were given, affording ample evidence of the suitability of the

* "Modern Labour-saving Implements," August, 1919, p. 486.

majority of tractors for this work. Many of the farmers in the district surrounding Lincoln have already adopted with great advantage this method of doing their threshing.

Conclusion.—The Lincoln trials were of great value from the commercial standpoint and were also of great educational value to the farmers who attended them. It is difficult to conceive of a better means of demonstrating the articles which a manufacturer has to sell or of affording a would-be purchaser a ready means of determining his choice. It should, however, be borne in mind that the trials were by no means exhaustive or final tests of the value or capacity of any machine. They cannot from their very circumstances afford any evidence of the durability of a machine, nor are they in any case strictly comparative, since there is no uniformity of test or conditions. The very favourable weather conditions under which the trials were carried out, while most happy from a commercial and probably from an educational standpoint, in themselves lightened the task both of the machines and the operators. The fields were selected so as to give, as far as practicable, uniform soil conditions, but there was very considerable, although unavoidable, variation in the plots allotted to the different types. Another point worthy of notice is the presence of the expert operator at trials of this character, and the personal factor undoubtedly comes into play to a very considerable extent. There is room for tests of a rather different character, extending over a considerable period, and so arranged as to give approximate uniformity of task and conditions. In this way a standard of comparison could be instituted far more exact than is possible under conditions such as existed at the Lincoln trials, and the durability of the machines, of the first importance to farmers, could be evaluated.

There is, however, room for both types of test, and neither could displace the other. The popular success of the Lincoln trials is undoubted evidence of the need for exhibitions of that character.

It remains to add that British manufacturers were well represented at the trials, and that the British-made tractors compared favourably in every way with the American tractors. Apart from American machines, only one foreign type, the F. I. A. T., was entered; in future years it is to be expected that French and other continental manufacturers will be represented, and a great deal may be learnt both by British manufacturers and farmers who have hitherto in the matter of tractors gone to school almost exclusively in America.

LAND RECLAMATION IN GERMANY.

THE following is an account of the present-day methods of peat land reclamation in Germany, written by Mr. G. B. Farlam, who was taken prisoner of war in May, 1915, and who, after spending a few months in a German hospital recovering from wounds, was drafted to the Royal Prussian Lands of Ostenholzer Moor, Hanover, where he was put to work as a labourer on the extensive reclamation scheme then in operation under the direction of the Prussian Ministry of Agriculture.

During the three years Mr. Farlam was kept at this work he made notes of the results of his observations, and he is to be congratulated on his endeavour to extract, in spite of the difficulties and hardships of his position, such information as he thought might be of use or interest to his own country.

RECLAMATION AND CULTIVATION OF "DEEP" PEAT LANDS.

Preliminary.—The writer's experience was obtained on the Royal Prussian Lands of Ostenholzer Moor, Hanover, about the latitude of the Central Midlands of England. The work was directed by officials of the Prussian Ministry of Agriculture.

Ostenholzer Moor is a low-lying moor of approximately 18,000 acres. Of this approximately 11,000 acres was under government control, the remainder being under control of a local authority corresponding to an English County Council. Plans had been made for drainage, cultivation, and division into small holdings, of the whole moor. The work in the portion under the "County Council" was much further advanced, several small holdings having been under occupation by peasants for several years.

The central portion of the moor was peat land with peat to a maximum depth of 12 yd. The stratum below the peat consisted of sand and gravel. Large tracts on the edge of the peat were sand, and these had mostly been afforested about 1885-7. Certain portions of the peat land had also been afforested at the same time. On the peat lands the natural growth was heather, a little grass of very coarse nature also growing in certain places. The peat was of a very fibrous nature, and of a light brown colour when dry. It was of little value as fuel, not being solid enough, but had been used for manufacturing peat moss litter. At the end of 1918 several thousand acres of this land had been fully drained, but

owing to scarcity of labour, materials, and especially of artificial manure, only about 450 acres of peat land were actually under cultivation in the portion under Government control. About 2,000 acres were under cultivation in the portion controlled by the "County Council." The methods adopted by the two authorities were similar in every respect.

Previous Cultivation.—The whole moor had been roughly drained by surface ditches of about a yard deep about 1880, for the purposes of buckwheat cultivation. This came to an end about 1895, and nothing further having been done these ditches were of little value as a means of drainage.

Methods of Drainage.—In the first place a system of main drainage canals had been dug over the whole length of the moor (see Fig. 1). These canals were placed at a regular distance of 530 yd. apart, dividing the whole moor into parallelograms. These drainage canals were 7 ft. wide at the surface, sloping down to 3 ft. wide at the water level, and averaged about 7 ft. in depth (see Fig. 4). They had 0·2 per cent. fall, *i.e.*, about 7 in. per 100 yd., and discharged into a larger canal, which discharged into the River Aller. For drainage purposes, the land was then surveyed out into smaller rectangles, so arranged that the length of the primary lines of drainage pipes ("farm tiles") should never exceed 150 yd. (see Fig. 2). These were laid out by a surveyor, and a complete system of trenches 1 yd. wide and 1 yd. deep was dug, and allowed to remain open for a year, during which time the land dried up sufficiently for further working. Trenches could not be dug to full depth right away as the land was so wet that the sides collapsed.

Immediately previous to pipe-laying the trenches were deepened to the necessary extent, the floor of the trench being made as flat as possible. Guide wires were fixed along the side of the trench under the direction of the surveyor, to show the correct depth. The pipes were laid on beds of heather cut in the immediate neighbourhood of the work, and a further covering of heather was placed on top. The trenches were then immediately filled in. Pipes should not be laid less than 5 ft. deep, and as great a fall as possible should be given, not less than 0·5 per cent.—half-a-yard per hundred. Pipes should be laid not more than 21 yd. apart, and in very marshy places 15 yd. Boards may be used in very marshy places to support the drain pipes. The writer saw drains laid by this method working well 10 years after being laid; pipes with 2 in.

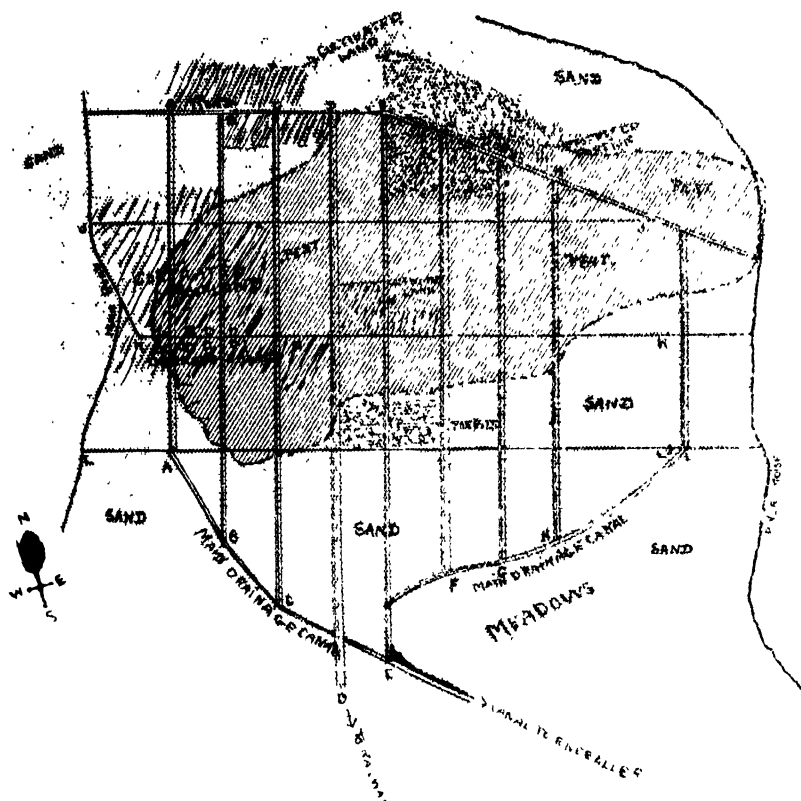


FIG. 1.—Sketch Map of Ostenholzer Moor, showing Drainage System. A, B, C, E, F, G, H, I, Canal with occupation road. D, Canal with light railway. Boundary of Government property. J, K, L, Traverse roadways.

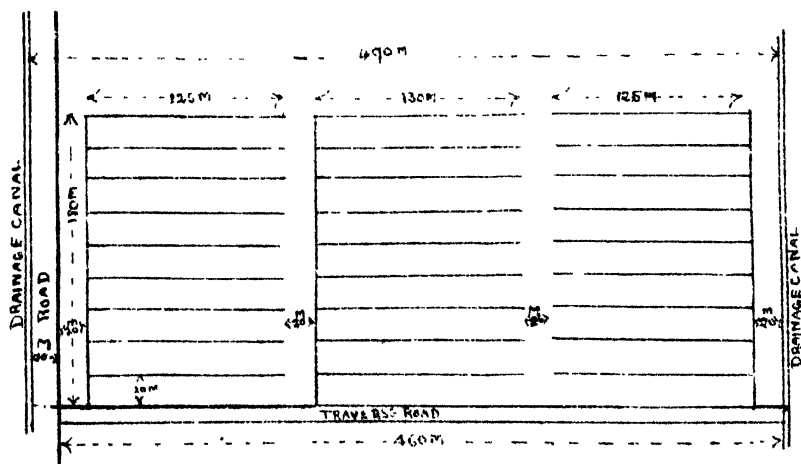


FIG. 2.—Drainage Systems.



FIG. 3.—Cross Section of Moor, from North to South (Not to Scale).

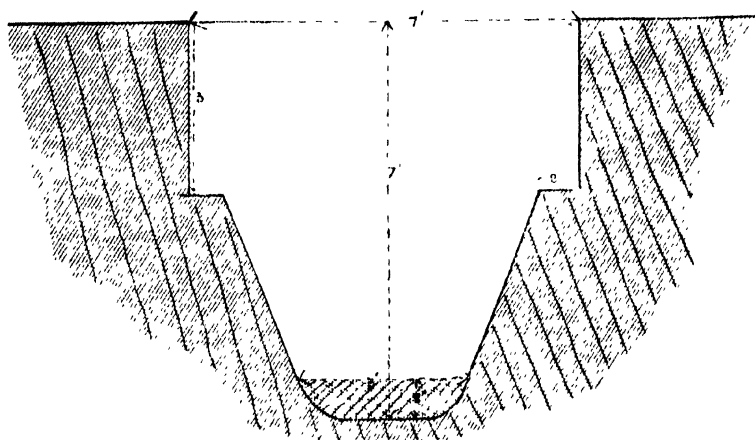


FIG. 4.—Section of Drainage Canal.

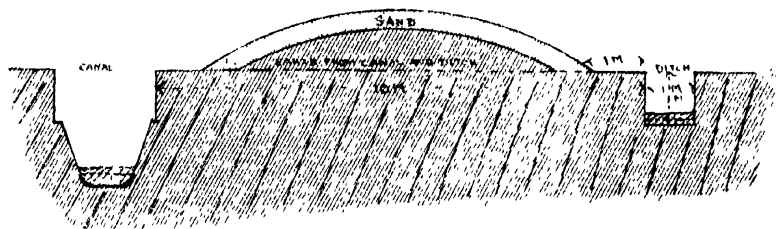


FIG. 5.—Cross Section of Roadway and Canal.

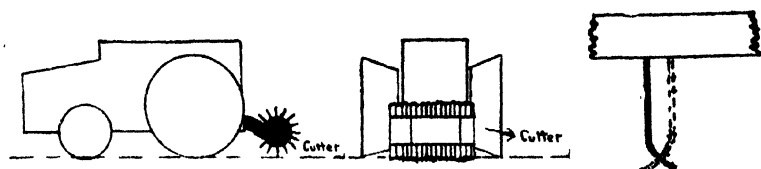


FIG. 6.—Sketch of Cultivation Motor.

Detail of Knives.

internal diameter were chiefly used, the collecting drains being laid with suitably larger pipes. It is important to note that drains must be laid as soon as possible after the trenches are deepened, on account of the danger of collapsing.

One man accustomed to the work can dig an average of about 20 cub. yd. of peat per diem. Therefore, for 1 acre of ground the labour required would be :—

Preliminary drainage	..	..	about 10 working days.*		
Deepening trenches	..	..	" 5	"	"
Pipe laying	..	..	" 3.5	"	"
Filling in	..	..	" 5	"	"

This gives a total per acre of 23.5 working days, or an actual labour cost alone of £9 8s. per acre, assuming the present standard rate of wages of 8s. per day be paid.

It is also to be noted that the work is not of a pleasant nature. The labourer is working in water practically all the time, and water-tight knee boots are essential. The fibrous peat is difficult to cut and has a tendency to stick to the shovel, and as the wet peat is heavy, and every shovelful must be thrown well clear of the trench, the work becomes very hard.

Roadways.—"Occupation" roadways were made along every canal, and cross roadways as shown in Fig. 1. These were made as follows: The earth from the canal, and from a ditch a yard wide and a yard deep dug 11 yd. away, was piled in the future roadway, leaving 3 ft. clear on each side (see Fig. 5). This earth was banked and levelled as neatly as possible, and was then covered to a depth of 8 in. with sand. This made roads that would stand the necessary traffic. The sand was dug in the neighbourhood, and was transported by means of a narrow gauge temporary railroad. It is calculated that each yard of road prepared like this means one working day, and each yard of canal and roadway two working days. In the case of this moor there were approximately 10 yd. of canal and 12 yd. of road per acre, *i.e.*, 22 working days. Thus, before cultivation commences, and without allowing for overhead expenses, expenses of management, cost of materials, cost of light railway, etc., there are to be reckoned 45.5 working days per acre, which at 8s. per day gives a labour cost of £18 4s. per acre.

* A "day's work" means the amount of work which could be done by an efficient workman during a day of 9½ hours.

These figures may be regarded as a minimum, as they assume that every man is an experienced and willing worker.

Cultivation.—The land was left for at least one summer after draining, if at all wet. The surface was then cut into small pieces by means of a motor-driven machine of special design (see Fig. 6) called a cultivation motor (Landbau motor). This machine was of 60 nominal horse-power, and was manufactured by the firm of Henrich Lanz of Mannheim, and cost 33,600 marks, say, £1,680, in 1916. It was supported on large wheels with a very broad rim, in order not to sink, and could cut the surface ground up very finely at the rate of 10 acres per day. It was also used without the cutter for drawing seeding machinery and rollers.

Before "ploughing" the land was treated with a dressing of a preparation of lime consisting of lime burned with about 10 per cent. of clay ("Kalkmergel"). The advantage of this over quicklime is that unless actually exposed to the rain it remains dry and pulverised. This compound is advised to be used up to 4 to 5 tons per acre, but the average application here was only 35 cwt. per acre, as larger supplies were unobtainable. This compound should also be used at the rate of 5 cwt. per acre every succeeding year, for the first few years, and it may be said, in general, that the more lime that is applied the better the crops. It was taken on the land by a narrow-gauge railway, and then spread by machinery of the usual type drawn by horses. The acidity of the ground, unless counteracted by lime, was shown by a thick growth of sorrel, a sure indication of acid soil, and any portions of the land which by chance had not received a fair application could be noted, owing to the poor crops and a plentiful growth of this weed.

After ploughing, the land was also dressed with applications of basic slag, crude potash salts, and calcium cyanamide. These applications varied in quantity, not only for various crops but also because under war conditions supplies were scarce and irregular.

For leguminous crops cultures of the suitable nitrogen bacteria were always used. The soil being free from the usual bacteria these had a fair chance, and the result was very successful, leguminous plants (clover, serradella, and peas), giving a fairly good crop even the first year of cultivation, and other crops grown on the land following leguminous crops so treated were considerably improved.

The weight per acre of the crops for the years 1916, 1917 and 1918, and for comparison, the usual crop per acre for light land, as given by the *Encyclopædia Britannica*, are as follows:—

<i>Actual Crops per Acre.</i>				<i>Normal Crops per Acre for Good Light Land.</i>
	1916.	1917.	1918.	
Rye .. ..	.. very poor	17 bush.	26 bush.	—
Oats .. ..	.. 15 bush.	22 bush.	32 bush.	45 bush.
Potatoes ..	.. less than 1 ton	5 tons	7 tons	10-15 tons
Clover (hay) ..	—	1·3 tons	2·8 tons (two crops per ann.)	2 tons

The figures for 1918 are from official returns, and are too favourable ; those for 1916-1917 are based on estimates by an experienced farmer. Root crops other than potatoes will not grow at all, at least in the earlier years of cultivation.

The effects of cultivation on the peat are that in a year or two it breaks down into a black pulverizable mass, easily worked, drying up very quickly in summer, and after prolonged rain getting so wet as to be unworkable. If the winter is a wet one, no work at all may be done on the land from November to March, and sometimes well on into April. If not too wet, ploughing may be carried on as usual. It may be noted that the general level of the cultivated land sinks, in this case, to the extent of slightly more than a foot in the first 4 years.

Horses have a broad, flat shoe attached to their feet when working on this land, to prevent them from sinking.

In general it may be remarked that if it had been possible to apply larger dressings of artificial manure, the results would probably have been slightly more favourable. On the other hand the weather of 1918 was most favourable for cereals, and the 1918 rye crop was considered very good for this land. The varieties grown were usually specially selected for the work, the potatoes being of a specially hardy red-skinned variety (known as Professor Brunkman), and the oats being black moor oats, while the clover was also from seed specially selected for this land.

Small Holdings on Peat Lands.—From general observation, and from the opinion of small holders occupying portions of this land, it could not be recommended for small holdings. The difficulty of working during the winter months, the fact that on account of the impossibility of growing root crops proper rota-

tion could not be arranged, the cost and labour of the necessary yearly applications of artificial manure, and the fact that cottages built actually on the land were damp and unhealthy, were all disadvantageous factors. On the other hand, land prepared as above after two years' growth of clover and fine grasses makes good summer grazing for cattle, and large tracts were leased by wealthier local farmers for this purpose.

Although before the War the Germans could obtain the labour of Russian Poles at a very cheap rate—the equivalent of 1s. per diem with very crude board and lodging—yet at the rents obtained on leasing it was calculated that it would take 80 years to pay the cost of draining, cultivation, etc. This work was, however, subsidised by the German Government in accordance with its general agricultural policy of developing all land in Germany to the greatest extent possible, and large sums of money were set aside every year for that purpose.

If the workmen employed on this land were paid a reasonable wage, the writer is of the opinion that peat lands reclamation on this system could only be profitable and advantageous under very exceptionable circumstances. It may roughly be said that it pays better in Germany to reclaim almost any other kind of waste land.

Afforestation of Peat Lands.—A large tract to the north of this moor had been afforested in the years 1885-7. This tract was partly sandy, and partly "deep" peat, and all the usual timber trees had been planted on both portions. The timber on the sandy portions had in general grown very well, but the immediately adjoining timber on the peat was of very poor quality. The only exception to this rule was in the case of birch trees, which seem to flourish equally well on either soil. The German authorities take advantage of this fact in planting wind breaks and ornamental trees on reclaimed land, these trees being almost invariably birch. Fruit trees grow on the reclaimed land, but cannot be said to flourish.

RECLAMATION OF LANDS WITH SANDY SUBSOIL AND OF DEFORESTED LANDS.

Preliminary.—Portions of the moor on which the writer was directly engaged, and the whole of the immediate neighbourhood, consist of sand mixed with coarse gravel, and a large amount of this land had been forest land; practically the whole land of the district having been reclaimed and settled within the last fifty years.

Drainage.—Where drainage is necessary the pipes need only be laid at a depth of 3 to 4 ft. ; otherwise the methods of drainage are similar in every respect.

Cultivation.—The cultivation machine described in the foregoing sections (p. 696) was used for breaking the layer of heather and turf to a depth of about 4 in. This was immediately followed by ploughing in the ordinary manner. By ordinary methods of cultivation a good average yield was obtained by the third year. Small holdings and farms in general on this land show very much better results than the peat lands, and every kind of crop, including wheat and tobacco, was grown.

"SHALLOW" PEAT LANDS.

At Scharnebek, by Luneburg, in the valley of the Elbe, there is a large Government farm of about 700 acres. The soil here consists chiefly of black peat to a depth of about 12 in., and the land had formerly been afforested. Though large portions of this farm had only been under cultivation for three years, yet on the occasion of the writer's visit in September, 1917, the whole of the crops could only be described as very good, potatoes, sugar beet, and swede turnips showing exceedingly good results. The drainage on this farm had been carried out in the manner described, and certain fields had been covered to a depth of 8 in. with sand, apparently without improving the yield to an appreciable extent. The writer is unable, however, to give any figures relating to this estate.

CULTIVATION OF BUCKWHEAT ON PEAT LANDS.

This is carried out as follows :—The land is first drained by open ditches every 20 yd., and the surface is then broken up into fairly large pieces—roughly 8 in. square. Formerly this was done by hand, but now by the "cultivator motor." As soon as the land is dry enough, usually about the early part of May, it is burnt, fires of the dry pieces of turf being lighted and spread broadcast. The whole surface of the land smoulders until the first shower of rain. The buckwheat is sown directly on this surface early in June, no other treatment being given to the land. The buckwheat ripens about the end of September, good crops being obtained.

MANUFACTURE OF FARINA FROM POTATOES.

H. W. RICHARDS,

Managing Director of the British Farina Mills, Ltd.

IT has become a platitude to say that one of the great lessons impressed upon this country by the War has been the need to make ourselves more nearly self-supporting. Yet those who have appreciated this lesson will find ever fresh interest in each new example of successful effort in the direction of home production.

New industries have been springing up as British enterprise has come forward to answer this demand, and among them all none can rank higher in importance than those which tend to foster and develop the interests of agriculture. It is with an example of such an industry that this article has to deal, namely, the production of potato flour, known to trade as Farina.

Prior to the War the industrial use of potatoes was unknown in this country, though Germany, Holland, and Japan had developed it with great benefit to agriculture and their export trade. Germany had five times as much land per 100 acres under potatoes as we had, and it is a well-recognised fact that her resources in this direction constituted the main factor in her resistance to the Blockade. Our own tardiness in appreciating fully the value of the potato has been made good to a large extent during the years of the War, and it remains to go on and avail ourselves still further of the wealth latent in our potato crops.

During the War the British Farina Mills, Ltd., arranged to furnish home supplies of this valuable commodity to replace those previously obtained from Germany, and it has not only succeeded in producing goods equal in quality to those of continental firms of long experience, but is now expanding on such a scale as promises to supply the whole of the home market.

Contrary to the impression usually conveyed by the term "potato flour," this product does not consist of potatoes dried and pulverised, but is the pure starch separated from the rest of the potato and called Farina.

The part played by starch in the life activity of the potato is of great interest. The substance is built up by the wonderful chemistry of nature from the simple constituents of food

and water drawn from the plant's environment. For the purpose of transport in the sap it is readily changed into the form of sugar, which is soluble and can be conveyed to one part for growth and to another part for storage in reserve. In the latter case it is deposited as starch grains of microscopic size. This explanation makes clear the advantage in allowing the haulm to die down before the potato crop is lifted, so that the sap may be withdrawn to the tubers and there deposit its strength as grains of starch.

The value of the Farina industry to the farming interests is so apparent as to need little emphasis. Absorbing as it does quantities of potatoes running into thousands of tons per week, it affords a steady market of great value to those who appreciate quick sales. It is a market of wider scope than the farmer has had when supplying potatoes solely for table use, for size is not of so great importance, and potatoes which are not fit for table use can be consumed in large quantities. Further, a great economy is effected with partially diseased material which was previously wasted. As all growers are aware, some forms of potato disease leave a considerable part of the tuber quite sound, yet crops attacked this way have had to be written off in the past as a complete loss because of their unfitness for human consumption. The Farina factories afford the farmer a ready market for such goods on the basis of the strict value of that part of the crop which remains sound. In other words, if one half of each potato has been destroyed by blight, the other sound half will still fetch its value for starch making.

Again, the output of by-products from this industry will prove of use to the farmer. By means of auxiliary plant in these mills the potato residues, which still contain a valuable part of the nourishment, can be prepared as a feed for animals in a greatly improved form. Manufactured in a cooked and concentrated form it will keep in store indefinitely, and will prove a more digestible and healthy food than the raw potato, besides having a wider range of use.

In considering what are the best kinds of potatoes to grow for the extraction of Farina, it may be said that the quality of the starch from different varieties need not be considered; attention is to be paid solely to the quantity of starch present. The starch content may vary very considerably, so that of two crops equally sound one may be worth half as much again as the other, because of its greater yield of starch when put through the mill. The best criterion of starch content is the density

or specific gravity of the potato; the higher the density the more starch there is present. The farmer will need to take into consideration the two questions of size of crop and density, aiming to get the highest yield of starch per acre. Of varieties grown in this country the following have given the highest values in the tests made: Golden Wonder, Scottish Farmer, Evergood, King George, and King Edward. These are, therefore, the types most desirable for factory use.

The manufacture of Farina is a continuous process, and the extraction of the starch is accomplished by means of grinding and washing. After two preliminary washings of the potatoes to remove the earthy matter, they are ground to a very fine pulp; this process serves to free the starch grains from the tissue in which they have been deposited. Then follow the sifting and washing processes of the starch, in order to separate the fibrous portions of the potato. Next comes the treatment which is perhaps the most vital of all, a prolonged washing by a special process, removing all flavour and discoloration and foreign matters. Finally, the operations of drying and dressing produce a fine, glistening white flour.

The factories needed must have a great floor space, and very large storage room is used also for keeping and preparing the potatoes.

The first factory, which started six months ago, is at Alexandra Docks, King's Lynn, and comprises three large buildings, of seven stories high, with a floor space of 130,000 sq. ft., and a power and lighting station which is fitted with engines of 575 h.p. and auxiliary steam-raising plant. The potatoes are handled mechanically from the dockside if they come in barge or steamer, and conveying bands take them right into the warehouse or into the machines. Railway lines are laid round each building so that incoming trucks can be dealt with at every point, all raw material handled automatically, and the finished product loaded for despatch.

All the other mills are on much the same lines, and each one will be able to deal with 1,500 tons of potatoes per week; thus these mills should use over 200,000 tons of potatoes during the year.

Farina is principally used by the textile trades, which are the largest consumers, and very large supplies are required also for the manufacture of dextrine and various classes of gums and other products of a like nature. In addition there are many other uses for it amongst manufacturing chemists,

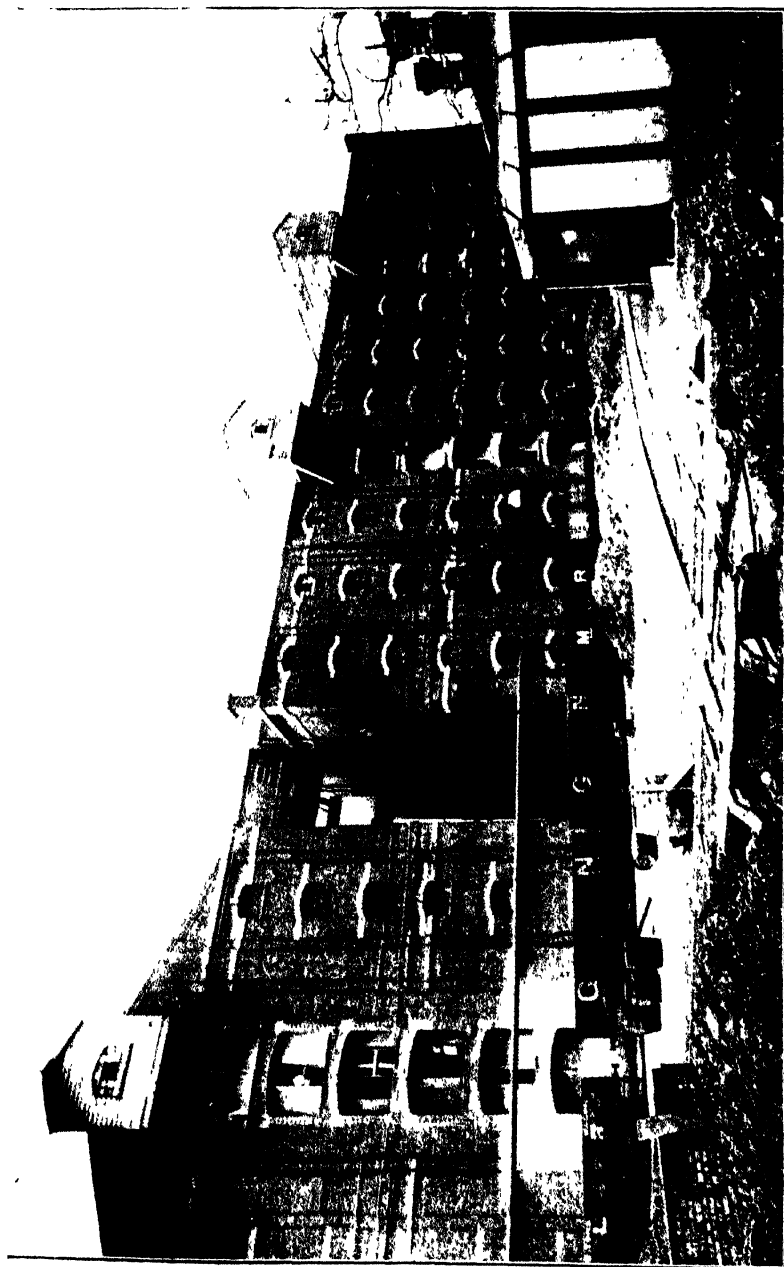


FIG. 1.—King's Lynn Mill. Elevation showing where Trucks of Potatoes are unloaded.

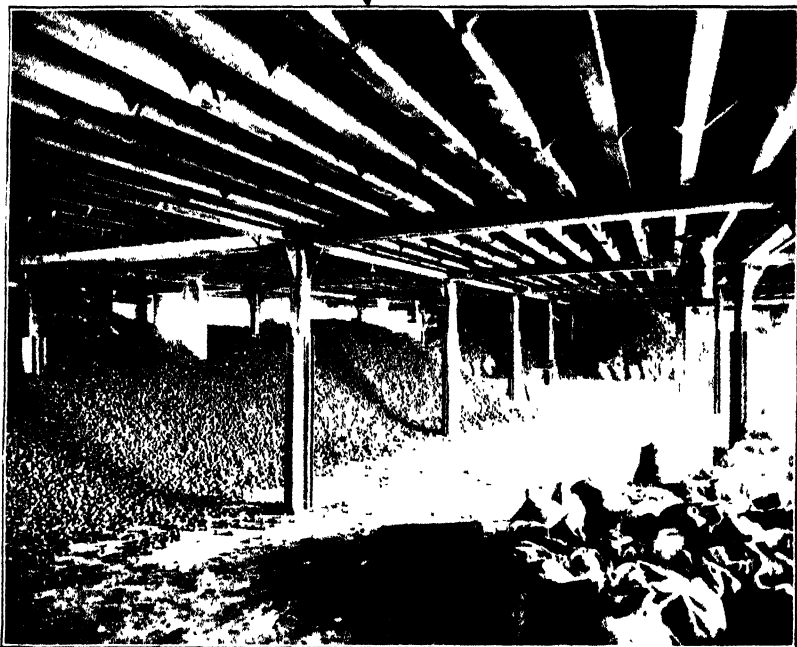


FIG. 2.—King's Lynn Mill. One of the Floors of Potato Store

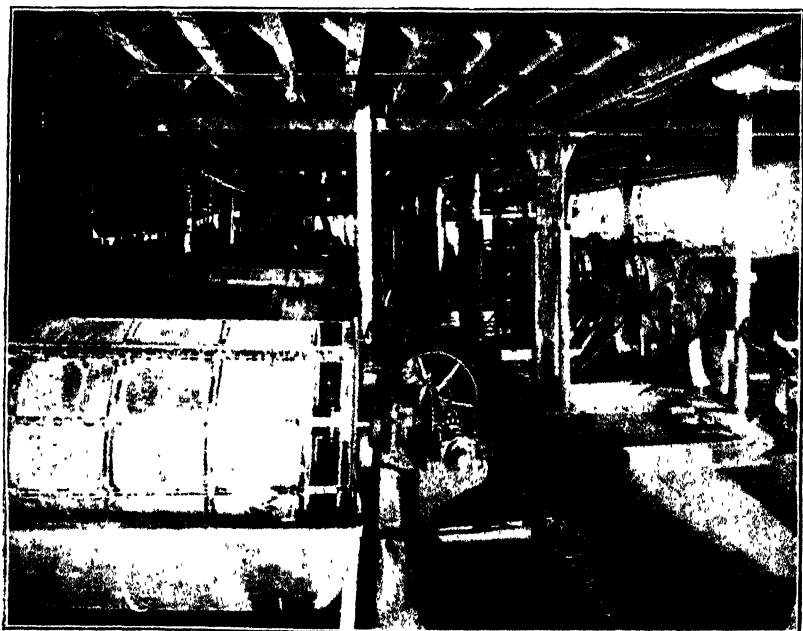


FIG. 3 —King's Lynn Mill. Floor showing Rotary Sieves.



FIG. 4.—King's Lynn Mill. Part of the Settling Table Floors.



FIG. 5.—King's Lynn Mill. Farina Packing Machine.

some of those developed in other countries being the production of artificial sago and grape sugar.

Finally, it may be pointed out that the value of the potato as an intermediate or cleaning crop, particularly for planting on newly-broken grass land, cannot be surpassed.

HOME PRODUCTION OF FOOD.

SHORTLY before the War, it had been calculated on the basis of returns of the agricultural output collected by the Departments of Agriculture that, excluding articles such as sugar, which are not produced in this country, about 50 per cent. of the total quantity of food consumed in the United Kingdom was home-produced. The proportions were very different for different articles, ranging from 20 per cent. in the case of bread to nearly 100 per cent. in the case of milk and potatoes. Working on the same data, a Committee of the Royal Society in 1916 reduced the various kinds of foodstuffs to the basis of food values,* and made calculations showing that in terms of "calories" about 46 per cent. of the food consumed in the United Kingdom (excluding sugar, cocoa and chocolate) was home-produced.

For at least a century this country has been steadily becoming less self-supporting. This, however, has been less due to decreasing home-production than to increasing population. The population of the United Kingdom was 21,000,000 in 1821, and in 1911 it was 45,000,000. Leaving Ireland out of account, as being practically self-supporting, the population of Great Britain increased from 26,500,000 in 1871 to 41,000,000 in 1911. The extent of land devoted to agriculture remained about the same during the 40 years, but whereas in 1871 it represented 118 acres for every 100 inhabitants, in 1911 it represented only 80 acres for every 100. The land under the plough declined both absolutely and relatively. During the 40 years the area of arable land decreased by 4,000,000 acres, and from 70 to 35 acres for every 100 inhabitants. The area of wheat was reduced by 1,500,000 acres, and whereas in 1871 there were 13½ acres of wheat for every 100 inhabitants, in 1911 there were only 4½ acres. Thus not only had wheat-growing failed to keep pace with the increasing

* See this *Journal*, February, 1917, p. 1046.

population, but the amount grown was sufficient for considerably less than half the number of population 40 years previously.

On the other hand, the production of beef substantially increased, the number of cattle in the country increasing by about 1,750,000. This increase of numbers did not keep pace with the growth of population, there being in 1871 about 20½ head of cattle per 100 inhabitants, and in 1911 not more than 17½ per 100. The number of cattle, however, is not a complete measure of the production, either of beef or milk. There are no comparative records of any value, and it was not until shortly before the War that authoritative calculations of the annual supply of meat and dairy produce were available. It is, however, probable that the home production of beef from a given number of cattle returned annually had on the whole increased. As regards milk, the increased production is fairly evident. The demand for milk not only increased with increasing population, but it is common knowledge that the consumption per head also increased. It is probable that the total consumption of milk in 1911 was not much less than double that of 1871. This enormously increased demand was entirely met by increased home supplies. With trifling and occasional exceptions, there were no imports of fresh milk, and the imports of condensed milk, though they substantially increased, remained a very small factor in supplying the requirements of the people. Of course, a very large part of the increased supply of milk was obtained by reducing the output of cheese and butter, but the increase of cows and the greater attention paid by farmers to milk production were the predominant causes. As regards mutton, home-production probably increased to some extent by improved breeding and feeding, but there was no increase in the total number of sheep, and relatively to population there was a substantial decline. On the whole, before the War about 60 per cent. of our meat supplies (including pig meat) was home-supplied; but, on the other hand, we produced only 40 per cent. of our butter (including margarine) and only 20 per cent. of our cheese.

During the War there was a marked increase in the cultivation of corn and potatoes. The following statement gives the acreage under wheat, barley, oats, and potatoes, respectively, in the United Kingdom as returned in June each year. The figures for 1914, of course, represent the pre-war position :—

Crop.	Area (in thousand acres).				
	1914.	1915.	1916.	1917.	1918.
Wheat ..	1,906	2,335	2,054	2,106	2,796
Barley ..	1,873	1,524	1,653	1,797	1,840
Oats ..	3,899	4,182	4,171	4,789	5,641
Total Corn ..	7,678	8,041	7,878	8,692	10,277
Potatoes ..	1,209	1,214	1,155	1,377	1,512

The figures for 1915 and 1916 represent the agricultural effort unaided by any direct action of the Government. Difficulties of labour, as well as in the supply of fertilisers and feeding stuffs, were encountered, in regard to which some indirect assistance was given by administrative action; but there was no attempt to regulate prices of farm products. The figures for 1917 and 1918 represent the results of Government intervention in the two main directions of compulsory cultivation and price-fixing. During this period the difficulties under which farming was carried on were immensely increased. All that need now be said is that the end justified the means, and that the end in view was largely attained.

The war record as regards live stock was somewhat less satisfactory, but in view of all the difficulties it may be described as remarkably good. The numbers in the United Kingdom as returned in June in each of the five years were:—

Class.	Number (in thousands)				
	1914.	1915.	1916.	1917.	1918.
Dairy Herd ..	4,595	4,495	4,499	4,515	4,604
Other Cattle ..	7,589	7,676	7,952	7,867	7,707
Total Cattle ..	12,184	12,171	12,451	12,382	12,311
Sheep ..	27,904	28,276	28,850	27,867	27,003
Pigs ..	3,953	3,795	3,616	3,008	2,809

The maintenance of the cattle and sheep of the country is a notable achievement, and although the loss of pigs is serious, especially in view of the difficulty of recovering our imports of bacon, it is at any rate consoling that this is the class of stock which can be most rapidly replaced.

The responsibility for home food production since 1916 has been shared between the Departments of Agriculture and the

Ministry of Food. There has been plenty of criticism of those who were responsible for administrative action, and it would not be contended, in the light of experience, that errors have not been made—errors of omission and of commission. But it may fairly be said that the results have justified the policy adopted and the action taken. Whether more or less might have been done, or whether what was done might have been better done earlier or later, will always be arguable, but on a general review of the war period it is difficult to contend that other lines of policy would have attained better results. It must be recognised, however, that no Government action would have secured these results without the patriotic co-operation of agriculturists generally. Landowners, farmers, and labourers have strenuously done their part in the common effort, and it is noteworthy that there has been practically no interruption of work throughout the War, or down to the present time, by disputes between employers and workers such as have from time to time affected other branches of the national output.

Will the impetus to home production which the War has given be continued or gradually die away? That is the question of the immediate future. For the time being, farmers are assured of prices for their main products which at least are not less than those under which they have increased their output, and are in some cases more. Prices are not only guaranteed for grain of the present harvest, but the Prime Minister has announced that the crops of 1920 shall be equally guaranteed. For meat, prices are guaranteed up to June next year, and for milk up to next spring.

Notwithstanding the fact that very confident predictions are not uncommon in certain quarters, the truth is that there is at present complete uncertainty as to the course of the world's markets in the main products during the next 12 months. If the problem were purely an economic one, it would be possible to make a reasonable forecast; but so long as the political situation in Europe remains unsettled, there are no firm premises on which to base conclusions. The War has stimulated the production of both corn and meat in all the great producing countries, and if the world's demand for the produce of these countries were no greater than before the War, the supplies in sight would be abundant. The world's effective demand for the immediate future is, however, entirely unknown. It is possible, though under present circumstances extremely difficult, to estimate the world's present requirements. But effective

demand is often very different from needs. It may be remembered that immediately after the Armistice, insistent statements were made as to the shortage of grain supplies then existing in Germany, but although Germany has been practically free to buy during the current year, and has been assisted by the Allies to do so, she has in fact taken only a moderate quantity. While, therefore, on paper Europe's demands appear very alarming, it still remains to be seen to what extent they will become effective. Not until this problem is solved and the political and economic position of Russia made clear is it possible to make any forecast of the future, and the only safe course is to prepare, so far as possible, for the worst event. It is evident that there is a risk during the next 12 months that world's supplies will be less than the world's demands, in which case world prices will, of course, remain at a high level. But the necessity for maintaining and increasing home production does not rest on insurance against world shortage. It is obviously of the utmost importance to reduce imports of all kinds to the lowest possible limits. The enormous increase in the amount which we have now to pay for imported foodstuffs was referred to in the issue of the *National Food Journal* for 13th August, and the urgent importance of endeavouring as rapidly as possible to reduce the adverse balance of trade was emphasised. Imports of raw materials are vital for our industries, and are remunerative, as a large proportion are re-exported in a manufactured state and thus swell our exports. Any idea that this country can ever become entirely self-supporting in food supplies is, of course, chimerical, nor from the trade point of view would it be desirable, so long as there are countries which can only pay in foodstuffs for the commodities they buy from us. But an increase in our home production of food is of supreme importance on several grounds. It would increase the national security, not only against the risk of war (which we fondly hope has been reduced), but against risk of interruption of supplies from other causes; it would improve our chances of re-establishing our commercial position in the near future; it would provide employment for a large part of the population under healthy conditions; and it would prevent this pleasant land of ours from becoming wholly, or too predominantly, industrialised. (*National Food Journal*, 10th September, 1919.)

THE VALUE OF FARM BOOK-KEEPING AND COST ACCOUNTING.

The Necessity of Book-Keeping to the Practical Farmer. - Strict book-keeping is one of the essentials of sound farm management. That this fact has not been more fully grasped by practical men in the past has been due to various factors.

The average farmer is primarily an open-air man. He works hard all day and does not concern himself much with account keeping. He likes to be out and about and hates to sit down to figures. He looks on out door work as productive and account keeping as unproductive. In some cases he takes to farming in order to escape from accounts and has been apt to believe that agriculture is the one industry which does not require bookwork.

Book-keeping is a subject which has not been included in the farmer's education to the extent that it ought to have been, and there is at present in many cases a lack of knowledge of how accounts should be kept. There is also a widespread impression that the keeping of books is a difficult matter beyond the power of the average farmer and requiring the employment of a clerk, which comparatively few farmers feel justified in doing.

Other farmers argue that they can always ascertain their position from their bank pass book. To say the least of it, this method must be described as very rough and ready, and owing, say, to increase or decrease in the amount of stock carried, the farmer might in certain cases be absolutely misled.

Without accurate book-keeping no farmer can tell exactly how he stands or how much he has made or lost over any period. It may be argued that even with the best-kept accounts he cannot tell exactly how he stands owing to variation in the standard of fertility of his farm or other factors, which can only be estimated. But he will know his exact financial position and the financial results of his farming over a given period. The farmer's books show him whether his past management has been on the best lines, and by judging from results he can vary his present and future policy. A farmer, therefore, who is desirous of obtaining the best possible results *must* keep books if his farm management is to attain the highest standard.

For other reasons which need not be gone into in detail, *e.g.*, income tax questions, labour problems, etc., books are necessary

to the present-day agriculturist. That he is aware of the fact is evident from the keen interest that is being taken in the the question of farm accounts at the present moment.

The information obtained from farm book-keeping may be classified as of two categories. The first class is that of general financial accounts, showing the overhead profit or loss and the general financial position. The second class is more detailed, and shows the working of each branch of the farm separately and the costs of each. In other words, the second shows the same information as the first category, but, in addition, shows in what branches the overhead profit or loss has been made.

Can Accurate Farm Costs be Ascertained?—Most farmers have a general idea of what branch of their work pays them and which does not, but a general idea is not sufficient, nor is it accurate enough to work on. On the question of labour expenses alone the calculation of the costings per acre of any crop may be far wide of the mark owing to the fact that adequate allowance may not be made for that percentage of his labour which is unproductive.

To get proper information one must go much farther than this system of estimating the costs of any crop or branch, and to be reliable the information must be obtained by subsidiary accounts which form part of the book keeping system.

The question as to whether it is possible to ascertain accurate costings is at present a much debated one. In the case of mixed farms the question is most complicated, as in many cases several classes of stock (some for breeding purposes, some for feeding, and some for sale as feeding stock) are kept, a complicated rotation of crops is in existence, and the position is made more difficult in other cases owing to the fact that the conditions in the district may be abnormal as regards ready market for produce, nearness to railway, etc.

Since the Agricultural Costings Committee commenced its work, a number of practical farmers have written saying that in their opinion the obtaining of accurate costings is impossible, while other men, whose experience and opinion is equally valuable, have written to say that costing is not only possible but necessary and desirable. Opinion in the industry is therefore divided.

The Agricultural Costings Committee fully realises the difficulties involved, but there seems no doubt that when these are considered with greater attention than has hitherto been the case, solutions can be found, and each year the results obtained should become more reliable. At the same time much useful

information could be got immediately by the ascertaining of ordinary cash costs, *i.e.*, strict analysis of all expenditure, including that for labour.

When the subjects of food consumption on the farm, manurial residues, increase or decrease of fertility, etc., are dealt with, the question of costing becomes more difficult, but there seems no reason why experience should not show means of surmounting the problems involved.

For some years past admirable research work into farm costs has been carried out in the United States, in Canada, on the Continent, and to a lesser degree in Australia and New Zealand. In Eastern U.S.A. and Eastern Canada, the farms are probably as much mixed farms as the prevailing average in this country.

A certain number of farmers in the United Kingdom have kept their costs for some years past. There seems, therefore, every justification for the belief that research into farm costs of production in this country will be as successful and obtain as valuable results as has been the case elsewhere.

What is Involved in Cost Keeping?—The ascertaining of agricultural costings simply involves the keeping of such financial records as are kept at present by many farmers, plus "departmental" accounts for the various branches of the farm. These extra "departmental" accounts involve the keeping of labour records, of statements of food (including pasture and roots) consumed on the farm, of records of how artificial manure and dung are used, and the analysis of all other expenses chargeable over the various fields or branches of the farm. At first sight, therefore, the impression is that a considerable amount of extra trouble will be thrown on the farmer who takes up cost keeping.

While it cannot be denied that additional supervision and care on the part of the farmer are necessary, it is pointed out that the assistance given by the costings officers on the county staff should reduce the amount of extra trouble thrown on farmers adopting this system to a minimum.

Secondly, the Committee forms have been and will be devised on lines which will involve the smallest amount of work consistent with the attainment of the necessary standard of accuracy. It will be possible to give a number of hints as to how labour involved in dealing with time records, food, and other records may be minimised.

What Value are Costings to the Practical Farmer?—Cost accounts will give the practical man a clear insight into the inner working

of his business, and will tell him which branches have rewarded him for his enterprise, skill, and outlay, and which have not. They will show up any error in his past policy, and will assist him in his management, and make for economy. From past results he will be able to judge better how he must vary his future policy by more intensive cultivation or manuring in certain directions, or by testing the profitableness of some new enterprise (subject to the limitations of his rotation). He will be able to compare his own costs in detail with those published for his district and type of farm, and will see where his own are more or less than the average.

He will be in possession of data which he had not had in the past. He can readily see what the operating cost of each implement and team per hour or day has been; he will know what each operation is likely to cost him per day or per acre, and by what type of equipment he gets the best results, *e.g.*, tractor v. horses.

The number of average effective working days per man and per horse he gets per year will be shown, and the loss of time from inclement weather and other conditions. He will know the length of time required for each operation, and which crops compete at the same time for labour and which do not, and, subject to weather conditions, will be better able to arrange his programme of work.

Further, he can ascertain what it costs to harvest each crop, how much it costs him to thresh and get the grain to market, and how much he must take into account for "broken time" and overhead charges when calculating the cost of any productive enterprise.

The records will show what rate of depreciation on implements, etc., he must provide for, and the lifetime of each implement. He will see at a glance the distribution of his capital over the various undertakings and branches of his farm.

He will know what it has cost him to cultivate each acre of cereals and roots, what these have cost him per unit, and the cost of his pastures will be available. Turning to live stock, he will know the minimum cost of breeding his young stock. He will know what it has cost him to produce milk. He will know whether his horse management has been good. And this note of information obtainable could be further extended.

The Value of Agricultural Costings to the Industry generally. Costs per acre, per qr., etc., of various crops, etc., will vary from district to district, and in any district according to the

different types of farms, efficiency of the farm labourers, type of equipment, efficiency in management, or other conditions, but, nevertheless, the guiding statistics which can be obtained should prove as valuable in this country as they have in other countries, and these should become more reliable each year as abnormal seasons and conditions are compensated.

From a general point of view much useful information should be readily available from cost accounts, *e.g.*, rates of capital necessary per acre in various districts, rates per cent. obtained, the most economic size of farm, *i.e.*, large or small holdings, the best type of equipment, *i.e.*, best implements and whether horses or tractors, etc., etc.

It would also be evident from statistics obtained over a wide area what districts are economically most suited to the production of particular commodities, and this and other similar information would be of considerable value.

The Value of Agricultural Costings from a National Point of View.—Much of the information obtainable, as outlined above, will be most valuable from a national point of view, and would be of assistance in the consideration of all questions affecting agricultural policy.

With evidence as to costs of production available it will be evident that if the market or other price of any product falls below a certain point, the land involved in the production of that commodity must be turned to other purposes, or a selling price allowing for the cost of production and a sufficient profit to the farmer guaranteed.

With evidence as to costs of production available, much of the suspicion which at present may exist between consumer and producer would be allayed.

Further, with this evidence forthcoming it would be possible more easily to preserve a proper balance and proportion between the landlord, farmer, and labourer, and thus would promote greater harmony between the three interests involved in the cultivation of the land, an industry of vital importance to the Nation.

(This article is also issued as a leaflet (A. C. C. 4) by the Agricultural Costings Committee. Copies of the leaflet may be obtained, free of charge, on application to the Director of Agricultural Costs, Room 237, Palace Chambers, Westminster, London, S.W. 1.)

THE season now opening presents the same problem to the farmer as last season, but some of the conditions are now much more favourable than they were; labour is more plentiful, supplies of manures and of feeding stuffs are no longer dependent on the fortunes of war, but rest largely with ourselves, more tractors are available, and implements can be repaired. The season has favoured early ploughing, and on many farms sowing will be earlier than usual, with consequent saving of seed and greater certainty of crop.

**Notes on Manures
for November:**

*From the Rothamsted
Experimental Station.*

The need for increased production remains as great as ever—if anything it is greater—and it has been repeatedly shown that more food for man and beast can be obtained from arable than from permanent grass land. The future of the industry depends on finding some solution of the old problem of maintaining land in arable husbandry and preventing it from going back to grass.

The chief factor in the fertiliser position is that farmers cannot afford small crops on their arable land. The expenditure on an acre of wheat before the War was about £5, but is now about £14. Only a good crop will repay this heavy expense: a poor crop costs nearly as much and returns considerably less. A good crop, however, cannot be assured unless fertilisers are used, and in their proper application lies one of the best prospects of successful arable farming.

It is not generally recognised how largely the British farmer availed himself of artificial fertilisers during the War. For the first time for many years the demand exceeded the supply. Sulphate of ammonia, of which formerly we had to export a large surplus, was especially largely used, the consumption by farmers in the United Kingdom rising from 80,000 tons before the War to 269,000 tons in 1919. The consumption of superphosphate rose from 560,000 tons in 1915-16 to 750,000 tons in 1919; while that of basic slag rose from 321,000 tons in 1915-16 to 540,000 tons in 1919. These figures demonstrate more vividly than any words the great increase in the use made by British farmers of the aids to crop production now at their disposal.

At the beginning of the new season the farmer should work out how much fertiliser he will need and then order it as early as possible. In an industry where local conditions play so important a part as farming it is impossible to lay down definite rules for universal application. The quantities

suggested below have been found to answer satisfactorily in many cases and may be taken as a basis for purposes of calculation, but other factors must be taken into consideration in each individual case.

Nitrogenous Manures.—The notice recently issued by the Board of Agriculture in regard to sulphate of ammonia* emphasises the need for early purchases. The prices are :—

<i>Month of Delivery.</i>	<i>Price per Ton in bags, net cash.</i>		
	<i>£</i>	<i>s.</i>	<i>d.</i>
October, 1919	20	10	0
November	20	15	0
December	21	0	0
January, 1920	21	7	0
February	21	15	0
March, April and May	22	0	0

These prices are higher than those ruling last year owing to the withdrawal of the Government subsidy and the substantial increases in wages and in costs of coal and other raw materials.

For the first time since 1916 there is the possibility that nitrates may be obtainable by farmers. Sodium nitrate is now appearing and may be expected in larger quantities as the season advances and more shipping becomes available. At present its price is high, but in any case no farmer needs it till spring. Another nitrate is perhaps more likely to appear on the market at an early date—nitrate of lime. Unlike nitrate of soda this is a manufactured and not a natural product, but it is made in Norway and has only a short sea voyage. During the War it was needed for munitions, but will now be available for agriculture.

Fortunately for farmers another very effective nitrogenous fertiliser—nitrate of ammonia—is being offered by the Ministry of Munitions at a considerably lower price per unit than that of any other nitrogenous fertiliser on the market. The Ministry is asking £25 per ton. Now nitrate of ammonia contains 33½ per cent. of nitrogen against 20 per cent. in sulphate of ammonia; further, one-half the nitrogen is in the form of nitrate, which is more active than the ammoniacal nitrogen. Inquiries for this material should be addressed to the Surplus Government Property Disposal Board, Explosives and Chemicals Department, Storey's Gate, Westminster, London, S.W. 1. It is understood that deliveries are made f.o.r. Swindon, Wilts, for orders in the south of England; and

* See this *Journal*, September, 1919, p. 645.

Saltney, near Chester, for orders in the north: the fertiliser is packed in barrels, which are supplied free.

A further nitrogenous manure that may soon be expected in quantity is cyanamide. Like nitrate of lime this also is a manufactured article and also has only a short sea voyage, so that it can be expected to arrive here, even with the present demands on shipping.

The outlook for nitrogenous fertilisers is therefore better than it has been. This is fortunate, because the need is at least as great as it was during the War. Maximum crops of cereals, roots and grass must be obtained, and to ensure this in Great Britain requires a liberal utilisation of nitrogenous fertilisers.

The probable requirements of an arable farm may be estimated somewhat on the following basis:—

Cereals.—All second straw crops are likely to require nitrogenous fertiliser in early spring: $\frac{3}{4}$ to 1 cwt. sulphate of ammonia, or 1 cwt. nitrate of soda or nitrate of lime, or $\frac{1}{2}$ cwt. nitrate of ammonia or $1\frac{1}{2}$ cwt. nitrolim could be allowed.

Cereals immediately following leys may require nitrogenous fertiliser in spring, especially if attacked by wireworm: 1 cwt. nitrate of soda or nitrate of lime per acre, or $\frac{1}{2}$ cwt. nitrate of ammonia, would serve for this purpose. A nitrate is necessary as the object is to help the plant speedily over a critical period.

Cereals after roots which received only little farmyard manure may be expected to respond to $\frac{1}{2}$ to $\frac{3}{4}$ cwt. sulphate of ammonia, or corresponding amounts of the other fertilisers mentioned above: so also may cereals after mangolds which are drawn off the field.

On the other hand, cereals after roots which are fed on the ground, or after leys free from serious wireworm infection, where there has been a good aftermath fed to sheep, will probably require no added nitrogen.

Roots and Potatoes.—All mangolds and potatoes may be given a nitrogenous dressing. Mangolds would really do better with nitrate of soda, but sulphate of ammonia, nitrate of lime or nitrate of ammonia serves quite well. Potatoes are probably best with sulphate of ammonia, but nitrolim is an effective substitute.

For mangolds one might allow up to 2 cwt. nitrate of soda per acre, or corresponding amounts of nitrate of lime, sulphate of ammonia or nitrolim. Nitrates are rather better than nitrolim or sulphate of ammonia. So much depends on the amount of dung available that it is impossible to give precise

figures : the mangold, however, will respond to a good deal of nitrogen, and owing to its importance as animal food it deserves liberal treatment.

Potatoes are rather better with sulphate of ammonia than with nitrate of soda ; they also deserve generous treatment because the cost of growing is in any case high and nothing but a large crop can possibly pay. Up to $1\frac{1}{2}$ to 2 cwt. sulphate of ammonia may be allowed.

Throughout the midland and southern parts of the country swedes and turnips, on the other hand, do not respond anything like as well as mangolds to nitrogenous fertilisers, the yield being more limited by the climate. If farmyard manure is being used it is doubtful whether any nitrogenous manure will be needed in addition.

Grass.—Grass land laid in for hay in the midlands and southern districts will almost certainly respond to sulphate of ammonia, nitrate of soda, nitrate of lime, nitrate of ammonia or cyanamide, the nitrates being on the whole rather more suitable, but with insufficient advantage to justify any great difference in price. Probably 1 cwt. per acre would be a suitable dressing.

Seeds Leys.—As a rule seeds leys receive no nitrogenous dressing : the exceptions arise when the clovers have been killed by bad weather and only grass remains ; some addition of nitrogenous fertiliser then increases the production of grass.

Pasture Land.—No general advice can be given as to the application of nitrogenous fertilisers to grazing land. In many cases they are not needed ; in other cases, however, they have proved useful by causing an earlier start in growth.

Phosphates.—The position as regards phosphates is more hopeful than it was last year, and farmers can look forward to sufficient supplies for their needs. Superphosphate and basic slag are the chief sources of supply : each has its special features, though both are to some extent interchangeable. The root crop is the chief consumer of superphosphate, and it needs this material partly to swell out and produce sufficient bulk, partly to increase the feeding value. Throughout the eastern and southern counties superphosphate is the better material : it can be given in quantities up to 3 or 4 cwt. per acre. In the west country and parts of the north basic slag is often equally good, especially where finger-and-toe is prevalent : 4 to 5 cwt. would be a suitable dressing.

Cereal crops benefit by a phosphatic fertiliser, especially in districts where the harvest is usually late and wet : the effect

of the phosphate is to hasten maturity, and it may bring about differences of 5 or 6 days in the ripening. Superphosphate is more reliable for this purpose than basic slag; about 2 to 3 cwt. per acre would usually be a suitable quantity.

In the southern and eastern counties where this effect is unnecessary superphosphate may still be applied with advantage to barley grown after roots folded off with sheep, especially where cake and corn have been given. Again, 2 to 3 cwt. is a suitable dressing.

Grass land, however, is the great consumer of phosphates, and in spite of all that has been done there is still need for more.

Land which received basic slag five years ago and responded may respond again. Of all methods of improving grazing land few are more effective than the proper use of basic slag.

Potassic Fertilisers.—The potash position is now fundamentally different from what it was last year, as Alsatian potash is now being produced, and samples have been submitted of the following composition:—

Description of the Salts.	Potassium Chloride	Sodium Chloride.	Calcium Sulphate.	Insoluble.
	Per cent.	Per cent.	Per cent.	Per cent.
Sylvinite 14 per cent., (French Kainit) 12·14 per cent. K_2O	19·25	60·66	2·5	10·12
Sylvinite 20·22 per cent. K_2O	32·35	50·55	2·5	9·10
Chloride of Potash 50·60 per cent. K_2O	80·95	4·19	1·2	—

In addition, German potash may be expected, and there is still the possibility of English potash. Farmers on light soils will do well to use potash this year on their potatoes, mangolds and grass laid in for hay, as the land is probably now somewhat depleted. Although lack of potash less generally causes trouble than lack of phosphates or nitrogen it is no less serious when it occurs, and this is not unlikely on light, chalky or peaty (but not fen) soils.

Assuming the bulk of the Alsatian potash to be up to samples received it would be necessary to apply 4 to 6 cwt. per acre of the sylvinite or French kainit to mangolds and 3 or 4 cwt. to meadow hay known to respond to potassic fertilisers. One to 1½ cwt. of the chloride would probably suffice for mangolds.

Lime or Chalk.—Winter is the best season for adding lime or chalk to the land, and it is to be hoped that the process which has begun so well will continue. So far as can be seen there

has been a distinct increase in the use of lime or chalk during the last two seasons : the figures available (the years ending 31st July) are—

	<i>Tons.</i> 1917.	<i>Tons.</i> 1918.	<i>Tons.</i> 1919.
Burnt Lime	142,000	213,000	183,000
Ground „	36,000	54,000	39,000
Ground Limestone ..	4,000	7,000	10,000
Ground Chalk. . .	2,000	16,000	13,000

There still remain, however, large areas where lime is needed. Carted chalk should be applied as early in winter as is convenient : lime, good limestone and ground chalk can be put on later whenever the land allows carts to travel. In order to determine how much lime is required it is necessary to decide whether the roots, clover, and grass will need it or not. If the roots are liable to finger-and-toe it may be presumed that they will respond to lime, unless they are receiving a heavy dressing of basic slag, in which case nothing further may be needed. If the clover is likely to fail it probably needs lime, particularly if the failure is in patches rather than general, such as might arise from faulty seed or from the spring drought. Grass shows its need of lime when it forms dark green patches, when clover tends to disappear and sorrel tends to spread. Sorrel alone is not a sufficient indication, since it is often found on soils well supplied with lime ; it is the absence of clover and the spreading of sorrel that afford evidence. In many cases, however, the difficulty is complicated by lack of drainage. No good result can be expected until this is remedied.

Storing of Artificial Fertilisers.—Assuming that the order for artificials has been placed early, the question of storage arises as soon as deliveries begin. All the manures dealt with in the preceding paragraphs will keep perfectly *provided they remain dry*. They are unaffected by air or time of storage (within the limits of the farmer's season), but they suffer considerably from damp ; the shed in which they are kept must, therefore, be quite dry. As the most expensive manure sulphate of ammonia will probable receive the most attention. If the shed is not well built the bags should be kept off the floor and stacked on a low platform made by laying some boards on bricks ; they should also be kept away from the outside wall. If, however, the shed is weather-proof, has a perfectly dry floor and an inside wall, the bags can stand direct on the floor without difficulty. Nitrate of ammonia is sent out in casks which should not be opened until they are wanted. Superphosphate should receive as much attention as sulphate of

ammonia in storing, as it is liable to lose condition if damp. If any of the manures are found to become a little lumpy on storage this can be remedied by breaking down with a wooden beater immediately before drilling.

A REPORT on the state of employment in agriculture in England and Wales at the end of July, 1919, has recently been prepared by the Board of Agriculture and Fisheries. It has been compiled from figures received from a large number of farmers to whom a circular letter was sent asking for certain information, and is based on the procedure adopted by the Industrial (War Enquiries) Branch of the Board of Trade during the War. Returns relating to employment in agriculture at the end of July, 1919, were received from 3,270 farmers, occupying 577,525 acres of arable, and 506,552 acres of pasture land. This amounts only to 3 per cent. of the land held as arable, permanent pasture or mixed grazings in July, 1914, a date which has been chosen, not because it is the most recent, but because it enables comparison to be made with the figures of employment at the same time.

It has been estimated that the approximate number of permanent civilian workers employed in agriculture in July, 1914, was 693,000 males and 57,000 females, while the number so employed in July, 1919, was 569,000 males and 75,000 females; but this is a considerable increase over the figures for July, 1918, which were estimated at 501,000 and 91,000, respectively, and still more over the estimated numbers employed in November, 1918, which were 489,000 (civilian) males and 73,000 females, so that since the signing of the Armistice there appears to have been an increase of some 80,000 civilian males and 2,000 females. This increase in civilian male workers has, however, been counter-balanced to a very large extent by the withdrawal of soldiers temporarily released for work on the land. In November, 1918, it is estimated that there were some 74,000 soldiers so employed, while in the last week in July there were less than 5,000. As the majority of these soldiers had become efficient workers, and were generally employed on the regular farm staffs, their withdrawal in such large numbers in so short a time has been seriously felt. It was estimated that in July, 1915, some 243,000 men had then enlisted from agriculture, and probably

some enlisted after that date, but even on the figures quoted there would appear to have been a loss to agriculture of some 147,000 men through detrition consequent upon enlistment. A certain number of men have been drawn in from other sources, probably mainly through the passing of old or less skilled workers from the ranks of casual agricultural labour to regular employment, but even if the 5,000 soldiers released from agricultural companies and at work on the land at the end of July be added to the 569,000 permanent civilian male workers, the number of regular male workers in July, 1919, was still some 119,000 below the pre-war number.

The percentage of increase in the numbers of permanent civilian workers employed in agriculture in July, 1919, over those of November, 1918, is 16·3 for all England and Wales. For purposes of the agricultural returns, England and Wales are grouped in 10 divisions, and an examination of the table printed in the Report shows that the percentage increase is approximately the same in each of the English divisions, except the north-west, where it is as much as 22·6. In Wales, however, the increase is only 9·5. Female labour has increased by 2·9 per cent., but this is due to the large increase of 39·3 in the south-east, for in six other divisions there is a decrease. These figures do not take into consideration the casual workers, who are estimated to number some 61,000 males and 73,000 females in July, 1919. From statements made it would appear that about 103,000 males and 118,000 females will be needed for harvest and other casual work at the end of September. Much will depend on the supply of war-prisoner labour.

The Report goes on to say that, from the tabulated figures and from the remarks made by farmers on the general outlook, certain features with regard to the state of employment stand out clearly. It is evident that the return of men from the Forces has had the immediate result of easing the situation. While a small proportion of farmers say that former agriculturists are not returning to farm work for one reason or another, the main body of testimony is that the men who were skilled workers when they enlisted are returning to the farms and are settling down well. A Cambridge correspondent says, "The supply of labour in this district is good, and men returning from the Forces are settling down to work as before the War"; while a Gloucester correspondent says, "Practically all returned soldiers are in regular work on the farms in this parish, and they are working well and willingly." The concurrence of the return of these men with a season of favourable weather and light

crops has minimised the need for labour, and the fact that the land is understaffed has mattered less than otherwise would have been the case.

The two other points that are brought out clearly in the Report are, first, that the farms are still understaffed, and that even on the most favourable expectations the number of men likely to be available is much below the standard of 1914. Moreover, the labour is less efficient. The proportion of males to females employed was, roughly, 12 to 1 in 1914; at the present time it is $7\frac{1}{2}$ to 1. Secondly, that on all sides farmers threaten to reduce their staffs even further. Many farmers say that the expense entailed in running their holdings is beyond what they reasonably can be expected to meet, and that the wages bill must be cut down. Others say that they are already carrying on with fewer hands than they need, while still more say they will have to reduce their staffs when the harvest is ended. The great body of criticism is directed against the reduction of hours of agricultural labour.

A series of Divisional Reports is printed at the end, consisting chiefly of extracts from farmers' remarks and comments on the general situation. (*Wages Board Gazette*, 15th September, 1919).

THE increasing difficulty in the provision and transport of food supplies for the Army during the War caused the Army Council

**Report of the
Army
Agricultural
Committee.**

to take all possible steps to promote the production of food in the various theatres of war and to develop agricultural production among the troops at home.

An Army Agricultural Committee was appointed in January, 1918, to co-ordinate the efforts which were already being made with this view by the military authorities. The Treasury, the Quartermaster-General, the Food Production Department of the Board of Agriculture, the Royal Air Force and the Directorate of Lands were represented upon the Committee, which was under the Chairmanship of the Right Honourable Viscount Harcourt.

An article on the work achieved by the Committee was published in the issue of this *Journal* for November last, p. 929. The Report of the Committee has now been issued (Cmd. 308), in which is given a full account of the work of food production accomplished by the Home Forces and in the various theatres of war during 1918. The Committee points out that the credit for

this work belongs mainly to the Army itself, to the officers and men who gave their time and services to it in addition, often, to their other duties, and to the directorates and other organisations for agricultural production abroad. In practically every unit of the New Armies it was easy to find land agents, bailiffs, farmers, nurserymen and market gardeners, whose presence greatly facilitated the work.

Attention may be drawn to four main points in the Report, viz. :—

1. The good work of the Home Forces resulting in the cultivation of 6,458 acres, and the realisation of a total profit of approximately £68,000, of which £30,000 has been paid to the State, the balance being the property of the units concerned.
2. The operations in France under the Directorate of Agriculture, interrupted by retirements and advances and other accidents of the military situation, but resulting in the cultivation near the Front of many thousands of acres of land, the saving of cereals which would otherwise have been lost on 18,000 acres, and the production on the spot, and therefore the saving in transport, of at least half a million pounds worth of vegetables.
3. The vast scheme undertaken by the Army in Mesopotamia for irrigation and cultivation resulting in the Army in that theatre at the end of 1918 being self-supporting in vegetables, and in both the native population and the Army being practically able to do without imported grain.
4. Operations undertaken by the Department of Agriculture at Salonika resulting in a large measure of success in the face of very serious obstacles, and in the saving of some 52,000 tons on transport and some £57,000 of expenditure.

These results speak highly of the work of the British Army in the production of food at a time when the shortage of food supplies and of shipping facilities throughout Allied Countries was extremely serious.

THE Committee appointed by the President of the Board of Trade, under the Chairmanship of Lord Colwyn, to investigate in all its bearings the question of increasing the supply of flax in the British Empire, has recently issued an Interim Report (Cmd. 281, 1919, price 2d. net.). It is stated in the Report that of the annual requirements of the United Kingdom before the War, which were normally about 100,000 tons, Ireland contributed some 10,000 tons, Belgium, France and Holland together about 10,000 tons, and Russia about 70,000 to 80,000 tons. The War, however, considerably interfered with these sources of supplies, and it became necessary to consider from what other sources flax could be obtained. Flax growing was markedly developed in the United Kingdom, while other flax fields within the Empire were encouraged.

It is stated, however, that the present condition of the supplies of flax is still far from satisfactory, and the future prospects of the linen industry of the United Kingdom are threatened by the shortage of supplies.

The Committee therefore feels that the Government support which has been given during the War (1) to foster the revival of flax growing within the United Kingdom and (2) to encourage its extension throughout the Empire, will require to be continued for a further period, and it makes the following recommendations :—

General.—1. It is undesirable that an industry so important as the British linen trade should remain largely dependent upon external sources of supply for its raw material, especially as the industry has proved to be indispensable in war-time.

2. The efforts made by the Government under the necessity of abnormal war conditions to foster the revival of flax growing in the United Kingdom and to extend its cultivation within the Empire have achieved a considerable measure of success, and it is essential that these efforts should be continued until the full value has been derived from them.

Great Britain.—3. (a) The efforts made under the stress of war conditions to revive flax growing in England and Scotland have been essentially experimental in their character, the main point being to determine whether under modern conditions, including the use of machinery and central retteries, it is possible to re-establish the industry on a large scale and on a sound economic basis. In Great Britain it is desirable that this

work should be continued until sufficient data are accumulated to provide a definite answer to this question.

3. (b) In the event of the result of these experiments being unfavourable to the continuance of the English and Scottish schemes on an economic basis, the question will still remain whether part of the area and of the establishment should be retained for further experimental purposes on the lines of purely scientific research.

3. (c) Research should be undertaken into the possibilities of further mechanical improvements in the means of cultivating and handling flax.

Ireland.—4. (a) The Department of Agriculture and Technical Instruction should at once take steps to develop and extend their existing schemes for the encouragement of flax growing in Ireland, and for this purpose they should be provided with funds to enable them :—

- (1) To provide further instruction in the cultivation and handling of the crop, and to devote special attention to the new districts where instruction is most needed.
- (2) To continue and extend their investigations into the selection, improvement and supply of the varieties of seed best suited to Irish conditions, and other questions affecting the growing of flax in Ireland.
- (3) To make permanent provision for the training of instructors and scutchers.
- (4) To give loans for the erection of new, and for the repair and extension of existing, scutchmills.

4. (b) *North of Ireland.*—The work of the Flax Society may also be regarded as mainly an experiment directed to the same problem as that of the English and Scottish schemes, and should in the same way be continued for such time as is necessary to secure its full experimental value.

4. (c) *South of Ireland.*—It is of the first importance that an experiment should be made on a sufficiently large scale to test the feasibility of reviving the flax-growing industry in the South of Ireland on factory lines, and for this purpose at least two units of the area of 1,000 acres each should be established in the South, as already recommended by the Committee.

Canada.—5. (a) The scheme for the supply of fibre seed from Western Canada should be continued until such a time as, owing to the return of normal conditions or the development of other sources of supply, the question of seed supply for the United Kingdom is put on a permanently satisfactory basis.

British East Africa.—6. (a) The results already achieved in British East Africa warrant the hope that success in this area is likely to be permanent. That nothing may be lacking on the part of the authorities to ensure this success, the Committee recommend :—

- (1) The provision at central points of machinery for the treatment of flax ;
- (2) The development of agricultural research and experiment in flax production in the Protectorate by such means as after suitable investigation the local Department of Agriculture may suggest ; and
- (3) The provision of expert assistance in the preparation and grading of flax for the market.

6. (b) The scheme for the settlement of slightly disabled soldiers in British East Africa should be adopted, and if successful should be made the first of other schemes for the settling of soldiers in this colony, where the conditions seem to be peculiarly favourable to the production of flax.

INTERESTING facts relating to the efforts made in this country to revive the flax-growing industry are contained in the First Annual Report of the **Report of the Flax Production Branch of the Board for the Year 1918.** Flax Production Branch of the Board, recently issued (Cmd. 216, 1919, price 2d. net). The Branch was formed in December, 1917, at the instance of the Flax Control Board, to encourage the home cultivation of flax in order to make good the diminished supplies, in consequence of the considerable falling off in imports of the raw material, owing to the cessation of trade with Russia, the German occupation of Belgium, and other war conditions.* It was imperative that urgent steps should be taken to conserve our seed supply for future sowing and to increase the production of fibre within the Empire, and the task submitted to the Board was to arrange for the growth of at least 10,000 acres of flax in Great Britain, to deal with the resulting crop in such a manner that the seed should be available for sowing in the spring of 1919, and to manufacture the straw into fibre suitable for aeroplane cloth and other military requirements.

* See also Note on p. 723.

The terms offered to growers were £8 10s. per ton total crop (straw with seed on), with free seed and a minimum payment of £14 per acre, whatever the crop. This last guarantee was offered to give growers the necessary confidence in embarking on an entirely new and not very popular crop. The Flax Production Branch also undertook to supply the labour for weeding and harvesting, if requested to do so, at a charge of £1 per acre for weeding, and a maximum of £3 per acre for harvesting (farmer providing horses and horseman), whatever the actual cost to the Branch might be. Thus, by supplying free seed and by fixing a minimum gross return of £14 per acre and a maximum cost of £4 per acre for what was to him the unknown factor of the special labour peculiar to this crop, a balance of £10 per acre was available to the grower for the ordinary operations of ploughing and preparation of the land, sowing, loading and stacking the crop, rent, taxes and profit.

Five centres were selected for flax growing, viz., at Yeovil, Selby, Peterborough, Suffolk and Fife. The acreage of land cultivated in 1918 was 12,352 acres, and the quantity of seed used was 26,290 bush, or 7,510 bags, of which 6,500 bags were Dutch seed. A few special seed drills and a large number of sowing fiddles were distributed at each centre for loan to growers, and a limited supply of sulphate of ammonia and flue dust was also provided at cost price. Mills and de-seeding stations were acquired for handling the crop, the de-seeding stations being of a temporary character, and taken over mainly owing to shortage of suitable factory premises, to avoid congestion at the main factories and to overcome anticipated difficulties of transport.

It was necessary largely to employ imported labour in weeding the crop, and the harvesting work was carried out mainly by voluntarily organised corps of both sexes, as well as by soldiers, prisoners of war, and women of the Land Army.

The exact returns of the yield of the harvest cannot yet be obtained, but, after making due allowance for short crops on which the guaranteed minimum of £14 per acre will be paid, it is estimated that the weight of the straw and seed will be approximately 26,500 tons, distributed as follows among the various centres :—

	<i>Total.</i>				<i>Cut. per Acre.</i>
Fife centre	2,750	tons.			41
Suffolk centre	3,200	"			37
Yeovil centre	6,700	"			39
Peterborough centre	7,550	"			48
Selby centre	6,300	"			48

The total cost of the guaranteed minimum payment per acre was £5.341, shown in the following table:—

Centre.				Acreage affected.	No. of Growers.	Average Crop per Acre.	Cost of Guarantee.
						Cwt.	£
Wife	..	..	..	155	27	24'6	547
Suffolk	..	..	..	558	40	25'3	1,807
Yeovil	..	..	..	382	29	24'9	1,322
Peterborough	..	..	..	399	22	23'5	1,602
Selby	..	..	..	29	5	27'7	63
Total	..	..	..	1,523	123	—	5,341

Much of the work has necessarily been of an experimental character, and the past year has been too abnormal for any satisfactory conclusion to be formed as to the possibility of working the enterprise as a sound commercial business. An unique opportunity appears to be offered, however, for the translation of a war undertaking into a rural industry of permanent value to the country. In order to achieve this, however, it would seem essential that the ownership of the mills by the Board should be continued for the present, to avoid financial loss on the mills.

In the fourth week of August one of the Board's officers visited two dairy farms in Cheshire on which various forage crops are being grown experimentally.

**Growth of Forage
Crops for Feeding
Dairy Stock.**

A note as to the success attending the work may be of interest to others, especially if regarded as supplementary to articles which have appeared in this *Journal* dealing with the soiling system.* Both farms are on extremely fertile soil, mostly sandy loam of considerable depth.

(a) This farmer occupies about 500 acres and keeps over 200 cows. It is understood that every individual of the herd has passed the tuberculin test, and the milk is sold as Grade "B" to the Manchester Corporation. The herd is kept up by careful breeding and retention of the heifer calves, but the selections are mostly from Welsh and Irish-bred cows. The milk yield is fairly evenly maintained throughout the year. An area of about 6 or 8 acres is occupied by a crop of hardy

* "Continuous Cropping," T. Wibberley, N.D.A., N.D.D., November, 1914, p. 701, and December, 1914, p. 817. "Farming on The Soiling System," Jas. C. Brown, P.A.S.I., August, 1919, p. 507.

winter greens and rape, which were sown together in June, the seed having been broadcasted at the rate of about 4 lb. per acre. The mixture was growing strongly and was about 9 in. to 10 in. high at the time of inspection. The crop is expected to be used early next March, and with a favourable winter should have produced a heavy weight per acre by the time cutting commences. The grower considers it likely to equal the weight of a crop of cabbage without possessing some of the disadvantages of the latter; it is more easily cut for the cows and leaves the land much cleaner, in addition to which the difficulty of dealing with the cabbage roots is avoided.

The potato ground was seeded, as soon as cleared, with hardy winter greens, which show vigorous growth. The cows will probably be allowed to graze these in due course.

The abnormally dry season has increased the value of the forage crops, and their usefulness has been thoroughly appreciated, in spite of the somewhat limited scale on which they were grown.

(b) The land occupied by this farmer extends to about 200 acres, and 75 cows are kept. Forage cropping has been developed here on a somewhat larger scale than in the preceding case. Crops of oats and peas, of considerable weight to the acre, have proved extremely useful in supplementing the pastures through the dry period. The forage is fed to the cows in the byre. The crop from about 1 or 2 acres is intended for the making of silage.

On adjoining land in the occupation of the same farmer was seen a mixture of giant rye, vetches and wheat. This is the second crop this year, the earlier one having been cut late in June. Cutting was recommenced on 10th August, and the second crop was partly sold for feeding cows and partly made into hay. At the time of the visit only a small portion of the second cut remained unused; this was at least 5½ ft. high and the rye was fast becoming hard. The question of whether ripened grain could be obtained from a second crop of this character appears to depend upon the season, and in general would probably be less economical than would be the consumption or use of the crop in its best forage condition.

A DRAFT Order has been prepared by the Board of Agriculture for the purpose of establishing a single Drainage Board to deal with the main channel and banks of the Great Ouse and its tributaries, and also with the internal drainage of such areas drained by those rivers as are not now under any drainage authority.

**Land Drainage of
the Great Ouse and
its Tributaries.**

The main river alone is 140 miles in length, and at present there is no authority which has any control over it or its tributaries above the southern limit of the Fens at Earith and Waterbeach, which is about 50 miles from the sea. The rateable area of the proposed Board will be over 480,000 acres, situated in ten counties, and of that area nearly a quarter has hitherto made no contribution to the cost of keeping the main channels and banks in order. In the greater part of the area affected by the draft Order, nearly 100 drainage authorities have been set up in the course of the 300 years over which the local acts and charters relating to the Fen drainage extend. The result has been that the precise duties and powers of many of the authorities are veiled in obscurity, the liability for the maintenance of the rivers is most inequitably distributed, and the cost of the necessary works is far in excess of what the lands hitherto liable to contribute to the upkeep of the main channels can be called upon to pay. It is, moreover, impossible for the multitude of authorities to deal in any comprehensive way with the problems presented by the river, and the work that can be done by them is necessarily of the nature of patch-work.

In accordance with petitions presented by seven out of the ten counties affected, the Board of Agriculture propose to establish a single authority, as indicated above, which will take the place of all the existing authorities so far as concerns the main channels and banks. This Board will ultimately consist of 27 members elected by all owners and occupiers of land in the district, and 9 members nominated by County Councils and the King's Lynn Harbour authority. For the first Board a list of representative men has been secured, every invitation to serve having been accepted. Provision is made in the Order for differential rating of various sections into which the district is divided, in respect of the works by which each will be benefited.

Rates will be levied by the new Board directly upon all lands in their district, and they will not call for contributions from other drainage authorities. The new Board and the existing

authorities will be independent of each other, the latter retaining all their powers relating to internal drainage, but surrendering all their powers relating to the main channels and banks.

No attempt is made to lay down what works shall be carried out, or what general policy shall be adopted by the new Board. The object aimed at is to establish an authority with such an extent of jurisdiction as will enable it to take a broad view of all problems and all interests, and with a rating area which will enable it to carry out the necessary works without placing an unfair burden of expense on any of the land benefited.

The inquiries and surveys which have preceded the drafting of the Order have been prolonged, and its preparation has been a task of great difficulty and complication. Persons with intimate knowledge of the subject have held, and hold, widely divergent opinions on questions of principle as well as of detail, and the interests which are affected are in many instances in direct conflict with one another. These views and interests cannot in all cases be reconciled by any paper scheme. It is believed, however, that even if some of them have necessarily to be abandoned or to suffer, the establishment of a single co-ordinating authority will be well worth the sacrifice involved, and will afford the only hope of keeping a great and very valuable area in full cultivation. The view has been strongly urged in certain quarters that the area rateable for the upkeep of the main channels should be still further extended, and that it should even include the whole watershed of the river. It may indeed be desirable that uplands which send large quantities of water down to the valleys and fens should contribute to the cost of carrying that water to the sea without damage to the low lands, but as it has for many centuries been established law that all drainage works must be paid for only by the land which they benefit, it is impossible to effect this object without fresh legislation to alter a principle of payment which has generally been accepted as fundamental; and there can be no doubt that any attempt to legislate in this way would be strenuously opposed. Meanwhile, the establishment of a single authority, which is needed immediately in order to prevent the recurrence of disastrous floods, would be indefinitely delayed.

THE Board of Agriculture in July last undertook considerable work on the right bank of the Ouse above Denver sluice. The

**The Great Ouse:
Drainage Improve-
ment Schemes.**

work was done by hand labour on the bank only, and consisted of strengthening the bank, and preparing it for dredging work. Sufficient preparatory work has been accomplished to enable dredging to be carried on with advantage for some months. The first of three dredgers purchased by the Board has now been completed and sent up river from King's Lynn.

The Board have already commenced dredging below Denver sluice. The plant with which the work was begun was not a success, but a new grub has now been installed which is working very satisfactorily. In undertaking work on the Ouse, both above and below Denver, the Board were actuated solely by what they felt to be the paramount and immediate necessity of taking some steps to increase the capacity of the river and to improve the banks so as to minimise the risk of flooding in the coming winter. They felt that it was not possible for any other existing authority to perform the necessary work, and that it was incumbent upon them to do all they could to tide over the interval that must elapse before a local authority can be established with jurisdiction over the whole of the main river.

It is neither the province nor the desire of the Board of Agriculture to take up duties or to assume control which should belong essentially to a local authority. The Board's ultimate aim is to establish such an authority, elected by those who will pay rates to it, and free to determine its own policy for the benefit of its electors. When such an authority is established the work of the Board on the river will be handed over to it, with as much of the plant as the authority may care to acquire.

OFFICIAL NOTICES AND CIRCULARS.

N.B.—The Orders which may be mentioned in this section of the JOURNAL may usually be obtained at the price of 1d. each from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, and 28, Abingdon Street, London, S.W. 1; 37, Peter Street, Manchester, and 1, St. Andrew's Crescent, Cardiff.

THE President of the Board (Lord Lee of Fareham) has written a letter to the Agriculture Executive Committees of England and Wales in the following terms:—

**President's Message
to Agricultural
Executive
Committees.**

"I desire to take the earliest possible opportunity after my appointment as President of the Board to send a message of encouragement to the Agricultural Executive Committees.

"I look back with much pleasure and pride to my association with them during the special food production campaign of 1917 and 1918, and I look forward with confidence to their co-operation and assistance in carrying on the work of maintaining agriculture in a healthy and prosperous condition and of securing the greatest possible output of food from the land.

"The Committees will not expect me to make any declaration of agricultural policy until I have had time to examine the subject in all its bearings and to obtain the assent of the Cabinet and Parliament to such measures as may be found necessary, but in the meantime I desire to urge all Committees to use their powers to the full to deal with cases in which land is being badly or negligently farmed and to enforce on all occupiers the observance of the rules of good husbandry.

"Firm, and if need be drastic, action on these lines, within the powers granted by Parliament, will be welcomed and supported to the full, not only by the Board but by all good farmers and public opinion in general. In this connection it is certain that the interests of agriculture cannot expect to receive sympathetic consideration by the urban and industrial population unless they are satisfied that farmers are making the best possible use of the land which they occupy."

THE following Circular Letter (No. 199/C. 6), was addressed to County Councils and Councils of County Boroughs in England and Wales by the Board on 28th August:—

**Land Settlement
(Facilities) Act, 1919.**

SIR,—1. I am directed to call the special attention of your Council to the provisions of the Land Settlement (Facilities) Act which received the Royal assent on the 19th instant, and came into operation on the same day.

2. Prints of the Act will be available shortly and should be obtained and studied carefully by the members and officials of Small Holdings Committees, but in the meantime the Board desire to state shortly the effect of some of the principal provisions of the Act as regards the creation of small holdings. A separate Circular will be issued dealing with allotments.*

* See p. 737.

Acquisition of Land.—3. The powers of Councils to acquire land compulsorily and to obtain vacant possession of land acquired by agreement are strengthened very considerably by the new Act. For a period of three years from the passing of the Act Orders made by Councils for the compulsory purchase or hiring of land will not have to be confirmed by, or receive the consent of, the Board, except in those cases where the land is subject to rights of common (proviso to Section 1 (1) and Section 28), or where the land forms part of a park or home farm, or of a "smallholding" as defined in Section 61 (1) of the Act of 1908 (Section 16).

4. When a compulsory Order has been made by a Council (and confirmed by the Board in those cases in which confirmation is necessary) notices of the Order must be given by the Council to each owner, lessee and occupier of the land in accordance with regulations, of which copies will be sent to you shortly.

5. The Council can then, in anticipation of the completion of their purchase, at any time after they have served notice to treat, give not less than 14 days' notice to each owner, lessee and occupier, and then enter on and take possession of the land, leaving the amount of the compensation payable to be settled subsequently (Section 2 (1)). A notice may apply either to the whole or to any part of the land included in the Order which is specified in the notice, so that Councils will be able to obtain immediate possession of the land required for buildings, roads, etc., without necessarily taking possession of the whole farm at the same time. If, however, the notice relates to land on which there is a dwelling house and the length of notice is less than three months, the occupier of the house may, within 10 days of the service of the notice, appeal to arbitration against the notice and in default of agreement the arbitration will be appointed by the President of the Surveyors' Institution (Section 2 (3)).

6. It should generally be possible, in view of the existence of these powers, to make a voluntary arrangement which will enable the adaptation of the farm to be proceeded with, but occupiers should, in most cases, be given early notice that they will be required to quit at the end of the current year of tenancy, and that the Council will then take possession.

7. The above provisions as to obtaining early possession of land apply, in effect, not only to land which is acquired compulsorily but also to land which has been agreed to be purchased subject only to the interest of a yearly tenant who is in occupation of the land (Section 2 (2)).

8. These provisions apply whether the Order for compulsory purchase or agreement for purchase is made before or after the passing of the Act.

9. In view of the importance of avoiding all possible delay in the settlement of ex-Service men and of the necessity of proceeding at once with any necessary works of equipment, I am to urge your Council to make full use of their powers of obtaining early possession. Up to the present time some 70,000 acres have already been acquired by County Councils this year, but if the powers conferred by the new Act are not used Councils may not obtain vacant possession of more than 23,000 acres at Michaelmas next.

10. Where a Council exercise their power of pre-entry they cannot withdraw their notice to treat under Section 39 of the Act of 1908.

11. The Act contains provisions enabling Councils to purchase land in consideration of the payment of a perpetual annuity, and limited owners are authorised to sell for such consideration (Section 9 and First Schedule). In view of the desirability of reducing as much as possible the demands on the Exchequer in respect of purchases for cash, Councils are urged to acquire land wherever possible for an annuity instead of for cash. The annuity method is specially suitable in the case of purchases from corporations, colleges, charities, glebe owners and other bodies who would re-invest the purchase money of the land and who would be satisfied with a fixed income charged on the county fund.

Assessment of Compensation in respect of Compulsory Acquisition.—

12. Under the Acquisition of Land (Assessment of Compensation) Act, 1919, which comes into operation on 1st September next, it is provided that the compensation payable in respect of any land that is acquired compulsorily by a local authority shall be determined, in default of agreement, by one of a panel of official arbitrators to be appointed under the Act. The panel will be appointed by a Reference Committee consisting of the Lord Chief Justice, the Master of the Rolls, and the President of the Surveyors' Institution, and the selection of the official arbitrator who will act in any particular case will be made in accordance with rules made by the Reference Committee. The Act also provides that the parties to any case of compulsory acquisition may agree to refer any question of disputed compensation either to the Commissioners of Inland Revenue or to an arbitrator agreed on between the parties, and for the present the Board raise no objection to either of these courses being adopted, provided that the approval of the Board is obtained before an arbitrator is appointed by agreement.

Management of Land.—13. Difficulties have arisen in the past owing to the limited powers of managing land which were conferred on Councils by the Act of 1908. These difficulties are removed by Section 12 of the new Act under which Councils are given wide powers of management of land. In particular, Councils will be free to carry out any necessary works of equipment or adaptation subject to the approval of the Board, where such approval is required, and to farm land themselves in cases where it is desirable or necessary to do so.

Sale of Holdings.—14. Important changes have been made under this head by the new Act. The sale of holdings has been greatly facilitated by repealing the requirements that a purchaser must pay not less than one-fifth of the purchase money in cash, and the maximum period over which the purchase instalments may be spread can be extended from 50 to 60 years by an Order made by the Council with the approval of the Board and the Treasury (Section 11 (5) and (6)). In addition, any person who has been a tenant of a small holding under the Council for not less than six years is given a statutory option to purchase his holding unless the Council obtain the consent of the Board to a refusal by the Council to sell the holding (Section 11 (3)). The purchase price of any holding sold to an existing tenant of the Council will be the value of the holding at the date of sale, less the value of any improvement executed by the tenant. Any sales of small holdings by Councils prior to 1st April, 1926, are subject to the approval of the Board (Section 11 (2)), and the Board are not prepared to sanction sales unless the purchase price is equal to the cost of the holding. Where the land was acquired some years ago the value may be substantially in excess of the cost.

15. The increased facilities for the purchase of small holdings should be made known both to the new applicants and to the existing tenants of the Council in case they desire to avail themselves of them. It should be made clear that all sales are subject to the conditions set out in Section 12 of the Act of 1908.

Preference to ex-Service Men and Women.—16. For the next two years the new Act requires Councils to give a preference in the sale or letting of small holdings to suitable men who have served at any time in the Forces of the Crown and to suitable women who are certified by the Board to have been engaged in whole-time employment on agricultural work for a period of not less than six months during the War (Section 11 (7)).

Loans to Tenants.—17. Section 18 of the new Act empowers Councils to make or guarantee or undertake to make or guarantee an advance by way of loan to any tenant or prospective tenant of a small holding provided by the Council for the purchase of live stock, fruit trees, seeds, fertilisers and implements, provided the Council is of opinion that the facilities for obtaining advances from a co-operative society are inadequate. Any such advances or guarantees are to be made subject to regulations made by the Treasury, and the Board are in communication with the Treasury on the subject and hope to be in a position to give further instructions to Councils on the subject at an early date. In the meantime I am to say that the Board propose (1) that advances should be made through the Joint Stock Banks on the recommendation of the Council with a guarantee by the Council, (2) that, as a general rule, advances should be limited to amounts not in excess of the capital in cash or kind already possessed by the applicant, (3) that no advance to any one applicant should exceed £500, and (4) that the maximum period for the repayment of any advance should be five years.

Control by the Board.—18. The new Act contains a provision (Section 10) requiring Councils to obtain the approval of the Board before acquiring any land during the period up to 31st March, 1926, and Councils should, therefore, continue to submit their proposals in regard to the acquisition of land to the Board for their approval. The position in this respect is for all practical purposes the same as has been customary in the past, and it will be convenient, therefore, that the same forms should continue to be used. It will not be necessary, however, in future to advertise schemes under Section 5 (1) of the Act of 1908.

19. I am to point out that the necessity of obtaining the Board's consent before land is acquired applies to land which is acquired compulsorily as well as to land acquired by agreement. Councils can obtain compulsory powers in respect of any land (subject to the exceptions mentioned in paragraph 3 of this letter) without reference to the Board, but they must not exercise those powers by the service of notices to treat or of notices to enter and take possession without first consulting the Board. Councils should, therefore, send to the Board a copy of each compulsory Order they make, together with a copy of the relative plan and a valuation of the land by the District Valuer of the Board of Inland Revenue or some other competent valuer. They should also inform the Board if they propose to exercise their power to enter and take possession of the whole or any part of the land and should submit an estimate of the sum that might be expected to be awarded by way of compensation to the occupier apart from the ordinary outgoing valuation. The Board will then inform the Council

whether they are authorised to serve notices to treat or notices to enter and take possession.

20. The general effect of the financial provisions of the Act are that the Councils act as the agents of the Board and at the Board's expense during the period to 31st March, 1926, and Councils must, therefore, obtain the Board's approval before incurring expenditure not only on the acquisition, but also on the equipment and adaptation of land. In particular it is essential that the Board's consent should be obtained to any capital expenditure in respect of which the Council propose to borrow, in order that the Board may recommend the Ministry of Health to sanction the loans. The Act contains also an express provision (Section 15) requiring the approval of the Board to the period for which any loan is borrowed, and the Board will expect Councils to borrow for the full periods sanctioned by the Ministry of Health. If shorter loans are raised the accounts will have to be adjusted on the basis of the loan charges for the full periods sanctioned. With regard to the expenses of management and of ordinary repairs, the cost of which is paid out of revenue, the Board desire to allow Councils as much freedom of action as possible, but the Board expect to be consulted as to the qualifications and salaries of the principal members of the staff engaged by the Council on the administration of the Act, and they rely upon Councils to scrutinise closely the number and salaries of subordinate officers, clerks, etc. The Board reserve the right to disallow any expenditure which in their opinion has been unnecessarily or unreasonably incurred.

Recoupment of Losses.—21. Detailed instructions will be issued in due course as to the procedure for the payment by the Board of any losses incurred up to the 31st March last on the whole of the small holdings transactions of a Council to that date, and also as to the payment of annual losses at the end of this and subsequent financial years up to 31st March, 1926. In the meantime I am to point out that payments by the Board will be confined in future to losses incurred on the small holdings account of your Council as a whole, and that separate payments in respect of the costs of acquisition will not be made in future under Section 21 of the Act of 1908, which has been repealed, or in respect of half the cost of ascertaining the demand for small holdings. The latter expenses should be charged against the revenue account of the small holdings undertaking, and the expenses of acquisition which the Board have been accustomed to repay under Section 21 of the Act of 1908, including all proper legal and conveyancing charges and costs, should be added to the purchase money or other capital expenditure in respect of the land and included in the amount of the loan. From past experience it should be possible for the Council, when the purchase price of a property is settled, to form a reasonable estimate of the costs which should be included in the loan, and such estimate should be submitted to the Board when application is made for approval of a purchase, in order that the Board may make the necessary recommendation to the Ministry of Health that a loan should be sanctioned. Resolutions authorising the raising of loans for the purchase of land should extend to the costs of acquisition, and applications to the Ministry of Health for sanction to borrow should state the nature of the costs included in the application.

I am, etc.,

(Signed) A. D. HALL, *Secretary*.

In a Circular Letter addressed to the London County Council, and the Councils of Boroughs, Metropolitan Boroughs and Urban Districts on 8th September, the Board of Agriculture point out the legal obligation of these authorities to assist in all reasonable ways the allotment movement, and urge the authorities

The Provision of Allotments.

to take all possible steps to notify any demand for allotments.

Indicating the amendments of the law relating to allotments, contained in the Land Settlement (Facilities) Act, 1919, which came into operation on 19th August, the Board emphasise the fact that the powers of Councils to acquire land compulsorily, and to obtain vacant possession of land acquired by agreement, are strengthened considerably under the new Act. For a period of three years from the passing of the Act Orders made by Councils for the compulsory purchase or hiring of land for allotments will not have to be confirmed by, or receive the consent of, the Board, except in those cases where the land is subject to rights of common or where the land forms part of a park or home farm. Councils can at any time after they have served notice to treat, give not less than 14 days' notice to each owner, lessee and occupier, and can then enter on and take possession of the land, leaving the amount of compensation payable to be settled subsequently. The provisions as to obtaining early possession of land apply, in effect, not only to land which is acquired compulsorily but also to land which has been agreed to be acquired subject only to the interest of a yearly tenant who is in occupation of the land.

The effect of these provisions is that Councils will be able to acquire land for allotments by a simple and rapid process. Failing acquisition and the right of immediate entry by agreement it will only be necessary for a Council to make a compulsory Order, which in ordinary cases will not require confirmation, and the Council can then take possession of the land on 14 days' notice. It should be possible, therefore, to satisfy any demand for allotments without delay, and Councils are urged to make the fullest possible use of their powers for this purpose. The Board regard it as a matter of urgent importance that the allotment movement should be encouraged to the greatest possible extent, not only from the point of view of the increase of food production but also on account of the social and political advantages of the movement.

As a general rule the capital value of land in urban areas is too high to permit of the purchase of land for allotments, and Councils will, therefore, usually proceed to hire any land they require. If they cannot obtain land on reasonable terms by agreement, they should make use of their powers of compulsory hiring, which are specially adapted to meet those cases where land has a prospective building value. Councils can make Orders authorising them to hire land compulsorily for a period of not less than 14 years and not more than 35 years, and the hiring can be renewed under Section 44 of the Small Holdings and Allotments Act, 1908, for a further period of not less than 14 years and not more than 35 years on giving notice to the landlord not more than two years and not less than one year before the expiration of the tenancy.*

The compulsory hiring provisions of the Acts enable Councils, therefore, to obtain a perpetual tenancy of land at a fair rent, which cannot be raised in consequence of their own improvements, and without

* See this *Journal*, September, 1919, p 652.

regard to any prospective value which the land may possess for building, mining or other industrial purposes, but subject to the landlord's right of resumption if he satisfies the Board that he requires the land for such purposes.

It should be noted that the absolute exemption from compulsory acquisition of holdings of 50 acres or less has been repealed by the new Act and that Councils will in future be able to make compulsory Orders for the acquisition of the whole or part of such holdings for allotment purposes provided that they are satisfied that the holding is not the principal means of livelihood of the occupier.

Under Section 23 of the Small Holdings and Allotments Act, 1908, as amended by the Land Settlement (Facilities) Act, 1919, it is the statutory duty of all Borough and Urban District Councils to provide a sufficient number of allotments to meet the demand from residents in the Borough or Urban District so far as this is practicable having regard to the financial conditions imposed. In the Act of 1908 the obligation was confined to the provision of allotments for the labouring population, but this limitation has been repealed by the new Act, and consequently applications for allotments from any class of residents should be dealt with. The new Act also repeals the words of the Act of 1908, which confined the obligation of the Local Authority to cases in which allotments cannot be obtained on reasonable terms by agreement between landowners and applicants.

If an allotment authority fails to provide a sufficient number of allotments, the County Council may act in default and may provide allotments at the expense of the Borough or Urban District Council. If the Board are satisfied, after holding a local inquiry, that both the allotment authority and the County Council have failed to fulfil their obligations, the Board may transfer the powers of the Council to the Small Holdings Commissioners in order that they may provide the allotments required.

By the Act of 1908 Councils were empowered, with the consent of the Board, to let land for allotments to an allotment association so constituted that the division of profits among the members of the association is prohibited or restricted, but there was no obligation on the part of Councils to provide land for an association. This is altered by the new Act, and Councils are now under a statutory obligation to provide allotments for allotment associations as well as for individual applicants. The new Act also authorises the sale as well as the letting of land to allotment associations. Moreover, Borough and Urban District Councils are authorised by the Act to promote the formation and extension of co-operative allotment societies. Councils may also, with the consent of the Ministry of Health, make grants or advances to co-operative allotment societies, and may borrow money for the purpose.

In conclusion, the Board express the hope that Local Authorities will make use of these powers to encourage the organisation of allotment holders on a co-operative basis and the formation of societies to assist them in the purchase of their requirements and the sale of their surplus produce. If any Local Authority is of opinion that such facilities cannot be obtained by the allotment holders from a co-operative society, the Council can itself purchase any fruit trees, seeds, plants, fertilisers or implements required for allotments and may sell them to the allotment holders, or in the case of implements allow their use at a price or charge sufficient to cover the cost of purchase.

THE following information affecting farmers was contained in a Press Notice issued by the Ministry of Food on 30th September :—

As from 2nd October, the per head charge payable by buyers of cattle on the live-weight basis is increased from 2s. 4d. to 13s. per cwt. On the same date the buyer of sheep on the live-weight basis will pay at the rate of 1s. 4½d. per lb. on the estimated dead weight, plus the value of the skin.

As from 6th October, the price of home-killed beef sold at Government authorised slaughterhouses will be raised to 1s. 3d. per lb. and of mutton to 1s. 3½d. per lb. The prices of offal will remain as at present.

From the same date (6th October) a Government charge of ½d. per lb. in respect of cattle sold in the dead weight will be deducted from the vendor, as is at present done in the case of sheep sold on the dead weight. The price payable to vendors of cattle on this basis will, therefore, be 1s. 2½d. per lb. including increase to farmers.

After allowing for the existing increases to farmers, which are not altered, the live-stock auctioneer will, therefore, have to collect for the Central Live Stock Fund 9s. per cwt. on live cattle and 2½d. per lb. of estimated weight of live sheep, together with the existing head charge of 1s. 6d. payable by the vendor. The amount payable to farmers in respect of cattle and sheep of 4th grade sold on the dead-weight basis will on and after 6th October be the amount realised, less in every case 3d. per lb.

As from 6th October new prices for beef and mutton will come into force. The new prices represent an all-round increase in the wholesale and retail prices of 2½d. per lb. No alteration is to be made in the price of pork and edible offals, and for the present the prices of veal will remain as recently announced by the Ministry. As from 6th October the wholesale prices of meat will, therefore, be as follows :—

<i>Per Stone of 8 lb.</i>					
				<i>Home Killed.</i>	<i>Imported.</i>
<i>Beef—</i>				<i>s. d.</i>	<i>s. d.</i>
Carcass	..	..	10	0	8 0
Hinds	..	..	11	0	8 0
Fores	..	..	9	0	7 0
<i>Mutton and Lamb</i>	..	..	10	6	8 6
<i>Pork</i>	..	..	10	8	9 6
<i>Veal</i>	..	..	7	0	5 10

It is stated in the Notice that these increases are rendered necessary by the increased cost of production, which has compelled the Ministry to pay for fat stock on an ascending scale which permits farmers to meet the heavier costs of fattening stock during the period when feeding stuffs are short and expensive. These prices are necessary in order to create a reserve fund, out of which the heavier payments to farmers for stock slaughtered in the winter and spring months will be met, and are so calculated as to be just sufficient to meet this object and leave no profit of any sort in the hands of the Ministry.

THE Board of Agriculture and Fisheries wish to point out to merchants and seedsmen selling immune varieties of seed potatoes for planting in areas infected with wart disease that it is

Wart Disease: proposed to issue at an early date an order
Immune Varieties. which will modify the restriction now in force that merchants must obtain licences for selling

such potatoes under the proposed Order.

Stocks of approved immune varieties which were inspected whilst growing and certified as reasonably free from rogues by either the Board of Agriculture and Fisheries or the Board of Agriculture for Scotland, may be introduced to and sold for planting on infected areas without any licence; but on the occasion of a sale for planting, the serial numbers of the certificate must be quoted on the invoice or other written document given to purchasers. No potatoes for planting other than these can be brought or sent into infected areas except under the authority of a licence issued by the Board.

The Board propose to work in the closest co-operation with persons introducing potatoes for planting into infected areas to see that the introducer of such potatoes has obtained either the certificate number of the inspected seed or the special licence to introduce other seed.

It should be pointed out that it is not the Board's intention to grant licences for the introduction of non-certified stocks until they are satisfied that the supply of certified stocks has been used up.

**Revocation of The
Swedes (Prices) Order,
1917.**

By an Order (No. 1174), dated 4th September, 1919, the Food Controller has revoked as from 11th September, 1919, the Swedes (Prices) Order, 1917,* but without prejudice to any proceedings in respect of any contravention thereof.

Owing to the Isle of Wight Disease, the stocks of bees in this country have been depleted to an alarming extent. The production of honey

**Official Scheme for
the Restocking
of Bees.** has decreased seriously and the fruit crops have suffered through the non-fertilisation of blossom owing to the lack of bees.

With a view to remedying this state of affairs, the Board of Agriculture in 1918 engaged the services of a bee expert, and a scheme to restock the country with bees was initiated. An investigation of the apiaries still in existence was first carried out, every part of the country being visited by the Board's expert. It was found that the total number of stocks remaining in England and Wales was only 32,500.

Simultaneously with these inquiries, investigations were made into the results which had attended local experiments in Kent and elsewhere to test the resistance to Isle of Wight Disease of bees of hybrid origin. It appeared from the evidence that hybrid Dutch and Italian bees possess a high measure of resistance to Isle of Wight Disease. The Board, therefore, developed a scheme for the introduction of Dutch bees for stocks and Italian queens for breeding.

In February last the Board's expert proceeded to Holland to purchase Dutch colonies in skeps, and he succeeded in securing 268 skeps, which were brought over in March without the loss of a single colony. Seven hundred Italian queens, purchased from one of the best breeders in Italy, were brought to England by post. To assist in the distribution of the stocks and queens, Bee Committees were formed under the Horticultural Sub-Committees in 40 counties of England and six in Wales, the bee-keeping interest being largely represented on these Committees.

The scheme provided that each Committee should issue shares to those desirous of obtaining nuclei from the imported stocks, each share to be liquidated by delivery of a nucleus. The stocks imported were sent to approved bee-keepers, who undertook to form restocking apiaries under the Committee's control; to purchase Dutch stocks at a price of £2 10s. each and Italian queens at 10s. each, and to provide nuclei to the shareholders at a cost of 30s. each, against a market rate of 50s. to 60s.

Restocking apiaries have been formed in Buckinghamshire, Cheshire, Cornwall, Devon, Derbyshire, Dorset, Hampshire, Hertfordshire, Isle of Ely, Isle of Wight, Lancashire, Leicester, Lincoln, Middlesex, Northamptonshire, Norfolk, Northumberland, Nottinghamshire, Soke of Peterborough, Somerset, Stafford, Surrey, Worcester, Yorkshire (6), Denbigh, Glamorgan and Pembrokeshire. The Board's expert has paid visits of inspection to the restocking apiaries, of which all except three have been well managed. An average of five nuclei Dutch bee stocks has been obtained from each imported stock, so that the country is already richer by 1,340 stocks of bees resistant to Isle of Wight Disease. Inasmuch as the scheme provides for the continued multiplication of the nuclei from the imported stocks, it may be expected that, in the course of a few years, many thousands of stocks of resistant bees will have been reared. Moreover, the official scheme has greatly stimulated private enterprise in the importation of foreign bees.

A SUB-COMMITTEE of the Food (War) Committee of the Royal Society has recently issued a report on the composition of potatoes grown in the United Kingdom (Harrison & Son, St. Martin's Lane, London, W.C. 2, price 2s.) The report introduces this subject with the following remarks: "The important part now played by potatoes in the national dietary makes it desirable that we should possess adequate and reliable information as to the composition and nutritive characteristics of our potato supplies." There are, of course, many factors other than the chemical composition which influence the value of the potato as a staple product of food, but for purposes of comparison a knowledge of the composition of the common varieties of potatoes should be of much use to many. It is true that farmers who grow on an extensive scale for market will naturally select those varieties which give attractive yields, but the small man who grows a few rods of potatoes to supply his own household would be wise, when selecting varieties, to give due attention to kinds which possess high feeding values.

The general public might give more than a passing thought to the matter, seeing that the difference between the feeding value of two kinds may vary considerably as shown in the accompanying table.

Varieties.	Number of Samples.	Dry Matter.	Nitrogen.
		Per cent. of Tuber.	Per cent. of Tuber.
<i>Late Varieties—</i>			
Arran Chief	52	23·31	0·345
King Edward VII.	47	21·15	0·323
Up-to-date	45	21·24	0·281
Evergood	20	20·83	0·343
President	9	23·49	0·346
Golden Wonder	2	27·24	0·447
Lochar	1	20·64	0·329
Templar	2	21·16	0·338
Irish Queen	1	25·90	0·529
<i>Early Varieties—</i>			
Great Scott	24	22·63	0·351
British Queen	17	22·39	0·306
King George V.	7	21·25	0·310
Royal Kidney	4	20·74	0·359
Ally	1	20·90	0·338
Burnhouse Beauty	1	24·31	0·402

The Report states that the usual criteria on which selection is based at present are crop yields, resistance to disease, and cooking qualities. There are obvious advantages in taking account also of the percentage of dry matter.

The prevailing popular idea has been that Golden Wonder possessed superior qualities for ware purposes to Arran Chief, British Queen or Great Scott, though these were regarded as being of much better quality than the close varieties such as Evergood and King George and Royal Kidney. A review of the table shows the interesting fact that the percentage of dry matter and the popular idea of quality of any variety have some element in common, and that the factor popularly expressed as the *quality of a potato* has now been given a definite status on scientific grounds.

The investigators made an attempt to determine the effect of general climatic influences, and it was shown that the percentage of dry matter was about 1 per cent. higher for potatoes grown in the eastern counties as compared with potatoes grown in the western counties. It is reasonable to assume, therefore, that the variation represents the effects of difference of rainfall.

WITH reference to the decision of the Agricultural Wages Board to reduce the statutory hours of labour on the land, the following correspondence has passed between the President

Agricultural Wages. of the Board of Agriculture (Lord Lee of Fareham) and the Chairman of the Wages Board (Sir Ailwyn Fellowes):—

Letter, dated 23rd September, 1919, addressed by Lord Lee to Sir Ailwyn Fellowes:

SIR,—I am informed that the Agricultural Wages Board have now decided to reduce the statutory hours of labour to 50 hours a week for

the month of October and 48 hours for the winter months, returning to 50 hours after the first Monday in March.

Exercising the powers conferred upon the Board of Agriculture under the Corn Production Act, I feel bound formally to request the Agricultural Wages Board to reconsider their decision. I am aware that the Agricultural Wages Board have not come to their conclusion without long and careful deliberation, and were it not for the grave national issues involved, I should not propose to invite so representative a body to review a decision which they have only just reached. But I feel there are certain national considerations to be weighed that have not perhaps loomed as large to the members of the Wages Board as they must do to me on finding it my duty, as Minister of Agriculture, to take a broad and impartial survey of the whole position of the industry.

The vital necessity before the nation at the present time is to increase home production in every direction. In no other way can we maintain our position and pay our debts. There is but one sure way of increasing production; every individual must do more work rather than less, and the share in the common burden cannot be shifted from one individual, or from one industry, on to the shoulders of another. In the case of agriculture the call is specially urgent; it has to supply the primal and urgent call for foodstuffs, and by its efforts alone can the rapidly increasing prices for the necessities of life be materially reduced. Its hours of labour have already been shortened, but as yet there are no signs that the old scale of production is being restored by a counterbalancing increase in the efficiency of the worker or in the organisation of the employer. Time is needed before either factor can show any real effect. Meanwhile, it has been recognised in all the discussions, international and domestic, upon the universal 48 hours' week, that agriculture in every country must be treated as an exceptional industry.

I therefore earnestly press upon the members of the Wages Board that there is a grave risk, not merely of checking production in agriculture, but of restricting most seriously the amount of employment, if too rapid or too drastic changes in the conditions of labour are forced under present circumstances. Farmers have always the alternative, and even the inducement, to cut down their expenses by reducing labour and by reverting to grass farming on all but the most profitable land. It is common knowledge that a great proportion of them are taking, or contemplating, this step. It is not my business, nor my inclination, to show partiality to either employers or employed, and I have come to the Board of Agriculture with the sole object of promoting production by every means in my power. But no orders to plough, no control of cultivation, nor any other form of State interference, can make it possible to conduct farming on uneconomic lines, or to make its labour conditions conform to those of urban industries.

In this connection I am convinced that a further reduction in the hours of work cannot but influence farmers still further in the direction of reducing their arable land, with a consequent increase in that volume of unemployment which is the most ominous symptom of the present situation.

In issuing this request to the Wages Board to reconsider their decision, I am thinking solely and entirely of the interests of the country as a

whole, and of *all* classes concerned in the prosperity of agriculture. I am, of course, aware that my action may be misconstrued, but I should feel that I had been wanting in my duty if I had failed to lay before the Board the conclusions that I have arrived at after the most careful and dispassionate consideration of a problem which ultimately affects the whole national welfare.

I am, etc.,

(Signed) LEE OF FAREHAM.

Sir Ailwyn Fellowes' reply, dated 24th September, 1919, to Lord Lee :

MY LORD,—On receipt of your letter of yesterday's date, I at once urgently summoned by telegram a meeting of the Agricultural Wages Board at 5 o'clock this evening. At this meeting your letter was read and carefully considered.

Before informing you of the decision of the Board, may I be allowed to call to your recollection the circumstances which have led to the making of the Order to which you refer. In the month of January this year, the workers' representatives on the Board gave notice of their intention to move for an increase of £1 per week in wages. The matter came before the Board in the month of March, and after three days' long debate, the employers and workers made a compromise on the basis of an increase for men of 21 years and over of 6s. 6d. This was based on a 54-hour week in summer and a 48-hour week in winter, with a reduction of summer hours in October, and for next summer to 50, any longer hours worked to be paid at overtime rates. On the strength of that compromise a proposal to reduce the summer hours from 54 to 50 was made about two months ago, and on the same grounds an Order was made (but not yet published in the *Gazette*) last Monday night.

The employers and the workers have had great difficulties to contend with, and it was only after long consideration and patience on both sides that they came to this agreement. To-day both sides feel as they did in March when the compromise was made, that there was an honourable understanding between them, and I am requested to say that neither side feel that they can break the agreement which they made after the most anxious consideration of all the circumstances of the case.

I am desired to add that both employers and workers hold the view that the question is really one of wages and not of hours, as there is nothing in the Orders of the Board to prevent any farmer from agreeing with his men to work regularly from 50 to 54 or any number of hours per week, provided the wages paid are not less than the minimum rates fixed.

Under these circumstances, the responsibility for any reduction in the number of hours actually worked in agriculture must rest with the employers and workers throughout the country, and cannot properly be made the basis of a charge against the Wages Board or their Orders.

Yours faithfully,

(Signed) AILWYN FELLOWES.

THE following Circular Letter was addressed to Agricultural Executive Committees by the Board on 25th September :—

Training of Disabled Officers in Agriculture under the Royal Pensions Warrant. SIR,—1. I am directed by the President of the Board of Agriculture and Fisheries to state, for the information of the Agricultural Education Committee, that the Board have taken over from the Ministries of Labour and Pensions the responsibility for the training in agriculture (including horticulture, market gardening, and poultry farming), of disabled officers, who are eligible for training under Article 7 of the Royal Pensions Warrant, and Lord Lee desires to invite the cordial co-operation of the Agricultural Education Committee in the local administration of such training as part of the general scheme of County Agricultural Education. Lord Lee feels sure that your Committee will afford the Board every possible assistance in ensuring that disabled officers who desire to be trained in agriculture under the Royal Pensions Warrant will receive the most sympathetic consideration, and that arrangements will be made to secure that the most suitable training possible is given in each case, having regard to the disability from which the individual officer is suffering.

2. Lord Lee suggests that the local administration should be delegated by the Education Committees to the Sub-Committees which are administering the Officers' Agricultural Training Scheme of the Board with such conspicuous success. In this connection, however, it must be pointed out that the scheme for the training of disabled officers under the Royal Pensions Warrant differs in principle from the Officers' Agricultural Training Scheme, in that whereas under the latter Scheme the Sub-Committees have in the main acted as Committees of *Selection*, and have practically a free hand in rejecting candidates, in the case of the former Scheme if an officer's disability is such as to prevent his returning to his pre-war occupation without being seriously handicapped physically or financially, he has a claim on the State to be trained in some other occupation. Where it can be shown, moreover, by medical evidence, that a disabled officer must, on grounds of health, take up an outdoor occupation, there is practically no alternative but for his being trained for an agricultural occupation, if he so desires. Any disabled officer who requires training, but whose training on account of his disability must be carried out under continuous medical supervision, will not be dealt with by the Board of Agriculture and Fisheries, but will continue to be dealt with by the Ministry of Pensions, who, it is understood, are arranging for such "treatment training" to be carried out in institutions, etc.

3. Article 7 of the Royal Pensions Warrant relating to the training—apart from "treatment training"—of disabled officers, reads as follows :—

"Grants to disabled Officers undergoing training :—

"An officer in receipt of retired pay under this our Warrant, may be granted in addition to that pay—

- (a) The difference, if any, between that pay and retired pay at the rate for the highest degree of disablement for any period during which he is prevented from earning his living, by undergoing training in a Technical Institution, or otherwise, which in the opinion of our Minister of Pensions would benefit him ;

- (b) An allowance to cover fees in respect of training up to such amount, and subject to such conditions as the Minister may determine."

4. In view of the fact that the allowances payable to disabled officers whilst training in agriculture will probably vary on every occasion on which an officer is "medically boarded" by the Ministry of Pensions, the Board propose to pay such allowances themselves direct to the officer, and, not as in the case of the Officers' Agricultural Training Scheme, through County Agricultural Education Committees. Any fees for training will, in like manner, be paid direct by the Board.

5. The Treasury have authorised the payment of training allowances up to a maximum of two years, to disabled officers whilst being trained in agriculture, and also, in addition, the payment of training fees up to a maximum of £50 to cover the entire course of training. The following conditions have hitherto been required to be observed before a disabled officer is placed in training in agriculture in England and Wales, and Lord Lee, as at present advised, has decided that these conditions shall still continue :—

- (a) An officer must be in receipt of disability retired pay, estimated to continue for a considerable period of the course of training, or his disablement must be such as permanently to preclude him from his pre-war occupation ; or
 - (b) He must be medically unfit to return to his pre-war occupation, (if any) ; and
 - (c) He must have a reasonable expectation of being able to support himself in the agricultural industry at the end of his training by obtaining employment or otherwise ; and in any case in which he desires to farm on his own account at the termination of his training, he must have the use of sufficient capital for the purpose with a minimum of £500 (apart from his pension).
6. The Board propose that disabled Officers shall be trained in agriculture in this country.

- (a) As "farm pupils" with individual farmers, market gardeners, etc., or
- (b) In exceptional cases at agricultural colleges.

In a few instances it may be desirable for the officer to receive training partly on a farm, and partly at an agricultural college.

7. The chief functions which County Agricultural Education Committees would be called upon to perform in connection with the training of disabled officers are :—

- (1) To advise the Board, and the candidates, as to whether they should, in their own interests, take up agricultural training, and, if so, the form of training best suited to the particular case ;
- (2) To assist suitable candidates to get into touch with suitable farmers, market gardeners, poultry farmers, etc., who would be willing to train them, with or without a training fee ;
- (3) To supervise the training, by means of visits paid by members of the Agricultural Education Committee, and of the County Agricultural Education staff, and also to arrange for the attendance of the officers during their training at any available County Agricultural Education courses.

8. A disabled officer who desires to apply for training in agriculture under the Royal Pensions Warrant, will be required, as heretofore, to make his application through the Ministry of Labour (Appointments Department) by whom his papers will be transmitted to the Board—including medical evidence that he is fit for the training he desires; the Board will, on receipt of the papers, communicate, where necessary, with the appropriate Agricultural Education Committee (or Sub-Committee) as to the case.

9. Lord Lee understands that the number of disabled officers at present in training in agriculture under the Royal Pensions Warrant is only about 150, and it is anticipated that not more than 300 further officers are likely to apply for such training.

10. The Board are obtaining from the Ministries of Labour and Pensions particulars of the cases of disabled officers at present undergoing training in agriculture, and they propose to forward to your Committee information concerning any disabled officer who may be in training in the county, in order that your Committee may arrange for his training to be supervised as far as possible, and for any necessary assistance and advice to be given to him. As previously mentioned, training allowances and fees, if any, will be paid direct by the Board.

11. Lord Lee would be glad if this letter could be brought before your Committee at an early date.

I am, etc.,

(Signed) A. D. HALL,

Secretary.

STATISTICS which have recently been issued by the Board* showing the changes which have occurred in crop production during the five years of war enable interesting comparisons to be made as to the result of the stimulus given to increased arable cultivation on account of the restrictions in imports. The total crops of cereals, including beans and peas, in the United Kingdom in each year of the War were, in thousands of quarters, as follows:—

—	1914.	1915.	1916.	1917.	1918.
Wheat ..	7,804	9,239	7,472	8,040	11,643
Barley ..	8,066	5,862	6,613	7,185	7,760
Oats ..	20,664	22,308	21,334	20,021	31,196
Beans ..	1,120	924	892	474	931
Peas ..	374	300	261	278	441

The alterations in the area devoted to these crops in each year of the War have largely accounted for the changes in the total production, but the variations in the yield per acre have also substantially affected the results. The average yield per acre in bushels in each year for the United Kingdom was as shown below, the mean of the five years being added:—

* Agricultural Statistics, 1918, Vol. LIII., Part II. Returns of Produce of Crops in England and Wales, with Summaries for the United Kingdom (Cmd. 298), H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2. Price 2d. net.

—	1914.	1915.	1916.	1917.	1918.	Average, 1914-18.
Wheat ..	32'8	31'7	29'1	30'6	33'3	31'5
Barley ..	34'5	30'8	32'0	32'0	33'8	32'6
Oats ..	42'6	42'9	41'2	43'7	44'5	43'0
Beans ..	30'7	28'0	30'4	18'0	29'7	27'4
Peas ..	23'0	24'4	24'4	21'5	27'5	24'2

It will be seen that the corn harvest of 1918 was on the whole the best of the five, that of 1914 being the next best. When it is remembered that in 1917, and still more in 1918, not only was a considerable area of land, presumably less suitable for corn growing, brought back into arable cultivation, but that also the shortage of labour and the scarcity of fertilisers were more acute than in the previous years, the result was highly satisfactory.

By reducing the corn crops to terms of weight a closer estimate of the contribution of the farms of the United Kingdom to the food resources of the country may be obtained, and for this purpose the production of potatoes may be added, the white straw crops—wheat, barley and oats—being differentiated from the pulse crops, beans and peas. The figures are in thousands of tons :—

—	1914.	1915.	1916.	1917.	1918.	Average, 10 years 1905-14.
Corn crops ..	6,221	6,308	5,880	6,746	8,472	6,165
Pulse crops ..	320	279	262	167	312	348
Potatoes ..	7,476	7,540	5,469	8,604	9,223	6,717
Totals ..	14,017	14,127	11,611	15,517	18,007	13,230

The yield per acre of potatoes in each of the five years was : in 1914, 6·2 tons ; in 1915, 6·3 tons ; in 1916, 4·8 tons ; in 1917, 6·3 tons ; and in 1918, 6·1 tons, the 10 years' average before the War being 5·6 tons.

The maintenance, in spite of great difficulties, of the herds of the country is mentioned in the Report as being probably on the whole the greatest agricultural achievement of the War. It may, perhaps, also be taken as showing that, while a plentiful supply of artificial feeding stuffs is, no doubt, essential to a high production of meat and milk—both of which have undoubtedly diminished—the number of stock which can be kept is mainly dependent on the supply of their natural provender—hay and roots. The total supply in each year of these crops is shown below in thousands of tons, with the pre-war average for comparison :—

—	1914.	1915.	1916.	1917.	1918.	Average, 1905-14.
Turnips and Swedes	24,196	24,431	23,318	24,842	22,835	26,517
Mangolds ..	9,523	9,696	9,010	10,369	10,321	10,005
Hay ..	12,403	12,449	15,198	13,163	12,332	13,903

In no year of the War was the crop of turnips and swedes up to the pre-war average, a fact which partly accounts for the inability of farmers to maintain the stock of sheep as well as of cattle, while in only one year, 1916, was the hay crop really good.

In regard to the 1918 harvest, the yield per acre and total production in terms of weight of wheat, barley and oats in England and Wales are estimated as follows :—

Crop.	Total Produce.		Yield per Acre.	
	Qr.	Cwt.	Bush.	Cwt.
Wheat	10,530,000	46,790,000	32·9	18·3
Barley	6,080,000	23,360,000	32·4	15·6
Oats	14,339,000	40,210,000	41·3	14·5

The total production of wheat straw was estimated at 3,081,000 tons in 1918, as compared with 2,048,000 tons in 1917 and an average for the previous 10 years, 1908–17, of 2,168,000 tons; of barley straw, 1,275,000 tons, as compared with 1,140,000 tons in 1917 and a ten years' average of 1,303,000 tons; and of oat straw, 2,881,000 tons, as compared with 2,097,000 tons in 1917 and a decennial average of 2,072,000 tons.

The Annual Report of the Chief Veterinary Officer of the Board for 1918 has recently been issued.* The principal feature of the Report is

Report of the Chief Veterinary Officer of the Board for 1918. the section devoted to *Rabies*. The history of the outbreak in this country during 1918 is briefly traced, and the steps taken by the Board to control the disease, both by prohibition of movement and muzzling regulations, are stated. A special organisation was set in motion at the Board's Veterinary Laboratory to accomplish expeditious diagnosis by tests in all reported cases, and as a result it became possible to give a definite diagnosis in as short a time as five hours after receipt of material, instead of from 14 to 30 days as obtained during former outbreaks. Devon and Cornwall were the only counties of outbreak during 1918, and the number of cases confirmed was 112. *Foot-and-Mouth Disease* occurred at Burwash, Sussex, but the outbreak was soon stamped out, and no case in any other area is reported. In regard to *Swine Fever*, the number of suspected cases reported during the year was 10,203, as compared with 10,261 in the previous year. The existence of the disease in 1918 was confirmed in 1407 suspected outbreaks (13·8 per cent. of the reported cases). Thirty-one outbreaks of *Glanders* in England and three in Scotland are reported, no less than 23 occurring in the London area. *Anthrax* decreased from 423 confirmed cases in 1917 to 246 in 1918, the decrease being stated to be due principally to the restricted importation of feeding stuffs and material of animal origin for the manufacture of artificial manures, which has been declining during the last three years. The number of outbreaks of *Sheep Scab* in Great Britain in 1918 was 357.

* Obtainable from H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2. Price 3s. net.

viz., 177 in England, 57 in Wales, and 123 in Scotland. *Parasitic Mange* showed the high figure of 4,483 outbreaks, the number of animals affected being 8,422, or 1·8 per outbreak.

THE preliminary tabulation of the agricultural returns issued by the Board on 20th September shows that the *total acreage* under crops and grass in 1919 in England and Wales amounts to 26,750,000 acres, of which 12,310,000 are *arable* land and 14,440,000 *permanent grass*; these items showing decreases, as compared with 1918, of about 90,000 and 147,000 acres respectively.

Agricultural Returns of England and Wales, 1919.

The acreage under *Wheat*, 2,221,000 acres, shows a decrease of 335,000 acres, or 13 per cent. during the year, but, except for 1918, is the largest since 1891. *Barley* shows a very small increase, but *Oats* have fallen from 2½ to rather more than 2½ million acres, but occupy the second largest area on record. *Rye*, with a very small increase, is again the largest area on record. *Beans* and *Peas* show increases of 13½ and 9 per cent. respectively.

Potatoes show a very largely reduced acreage, the total, 476,000 acres, being only three-fourths that of last year, and but little greater than the pre-war average. *Turnips* and *Suedes* show a material recovery, and are only just short of a million acres; while the *Mangold* acreage is slightly reduced.

Among other crops the most noteworthy changes are the increases in the area under *mustard* (which has recovered the area in 1916), *cabbage*, *rabe*, *vetches* and *celery*; while the most important relative decreases have taken place in *kohl-rabi* (the smallest acreage on record), *onions* *chicory* and *sugar-beet*.

The area under *clover*, *sainfoin*, and *grasses under rotation*, as might be expected as a consequence of last year's large addition to the arable land, shows a material increase, viz., over 160,000 acres, one-third of this being in the area reserved for hay. The total area reserved for *hay*, viz., 1,500,000 acres of clover, etc., and 4,170,000 acres of permanent grass, amounted altogether to 5,670,000 acres, or some 73,000 acres less than last year: the total area to be grazed shows an increase of 88,000 acres. The dry spring is no doubt accountable for the smaller area of the hay crop; and to the same cause (at least in part) may probably be attributed the large increase in the *bare fallow*, 650,000 acres as compared with little more than 400,000 last year, and about double the normal acreage.

Horses used for agriculture, including breeding mares, show a small decline; but a small increase in unbroken horses nearly counterbalances this; and other horses (saddle, vanners, etc.), on the farm also show a rise, so that the total of all horses on the farm is some 10,000 more than last year.

Cows in milk are more numerous than in 1918 by 85,000, or 4½ per cent.: the total, 1,944,000, is the largest on record. *Cows* and *heifers in calf* show, however, a material decline, but the total of cows and heifers, in milk or in calf, amounts to 2,554,000, or only 25,000 less than last year's record. Other cattle show a slight increase, but only in the class over two years, the younger animals decreasing by about 5 per cent. The *total of all cattle*, 6,195,000, is just 6,000 below last year's figure.

LIVE STOCK.

DISTRIBUTION.	1919.	1918.	INCREASE.		DECREASE.	
	No.	No.	No.	Per Cent.	No.	Per Cent.
Horses used for Agricultural purposes (including Mares for Breeding)	814,180	822,430	—	—	8,250	1.0
Unbroken Horses { One year and above	230,840	227,560	3,280	1.4	—	—
(including Stallions) { Under one year	108,980	100,070	8,910	8.9	—	—
Other Horses	237,810	225,770	12,040	5.3	—	—
TOTAL OF HORSES	1,386,810	1,375,830	10,980	0.8	—	—
Cows and Heifers in Milk	1,948,880	1,848,200	85,460	4.6	—	—
Cows in Calf but not in Milk	292,380	335,090	—	—	42,730	12.8
Heifers in Calf	817,480	584,680	—	—	67,200	17.5
Other Cattle:—Two years and above	1,167,170	1,000,770	166,400	16.6	—	—
“ “ One year & under two	1,271,420	1,338,510	—	—	67,090	5.0
“ “ Under one year	1,208,500	1,283,240	—	—	80,740	6.3
TOTAL OF CATTLE	6,194,590	6,100,490	—	—	5,900	0.1
Ewes kept for Breeding	5,768,940	6,486,760	—	—	722,840	12.1
Other Sheep:—One year & above	3,567,830	3,160,720	406,910	12.9	—	—
“ “ Under one year	8,791,850	6,827,640	—	—	1,036,030	15.2
TOTAL OF SHEEP	15,128,620	16,475,180	—	—	1,351,900	8.2
Sows kept for Breeding	251,850	289,540	—	—	37,690	13.0
Other Pigs	1,547,710	1,407,530	140,180	10.0	—	—
TOTAL OF PIGS	1,799,560	1,697,070	102,490	6.0	—	—

THE following is a PRELIMINARY STATEMENT compiled from the Returns collected on 4th June, 1919, showing the acreage under hops in each county of England in which hops were grown, with a comparative statement for the years 1918 and 1917. It is dated 15th

Acreage of Hops.

September, 1919:—

Counties, etc.	1919.	1918.	1917.
	Acres.	Acres.	Acres.
Kent { East	2,529	2,371	2,351
Mid	3,652	3,336	3,667
Weald	4,378	4,032	4,447
Total, Kent	10,559	9,739	10,465
Hants	757	717	790
Hereford	2,421	2,331	2,629
Surrey	181	193	189
Sussex	1,443	1,310	1,478
Worcester	1,373	1,328	1,342
Other Counties	47	48	53
Total	16,781	15,666	16,946

THE Board are in receipt, through the Foreign Office, of a copy of a Notice of Quarantine No. 39, dated 2nd July, issued by the United States Department of Agriculture (Federal

United States: Horticultural Board) to prevent the further **Quarantine Measures** introduction into the United States of the **regarding Importation** plant diseases known as "Flag-smut" and **of certain Cereals.** "Take-all." The provisions of the Notice are as follows:—

"The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that two dangerous plant diseases, namely, Flag-smut (*Urocystis tritici*) and Take-all (*Ophioholus graminis*), not heretofore widely prevalent or distributed within and throughout the United States, exist in Australia; that Flag-smut is known to exist in India and Japan and Take-all in Italy, France, Germany, Belgium, Great Britain, Ireland, and Brazil, as well as Australia. The Flag-smut disease affects wheat (*Triticum*) and the Take-all disease affects wheat (*Triticum*), oats (*Avena*), barley (*Hordeum*), rye (*Secale*), and rice (*Oryza*)."

"Now, therefore, I, Clarence Ousley, Acting Secretary of Agriculture, under the authority conferred by the Act of Congress approved 20th August, 1912, known as the Plant Quarantine Act, do hereby declare that it is necessary, in order to prevent the further introduction into the United States of the dangerous plant diseases mentioned above, to forbid absolutely, effective 15th August, 1919, the importation into the United States of seed or paddy rice (*Oryza* spp.) and of all species and varieties of wheat (*Triticum* spp.), oats (*Avena* spp.), barley (*Hordeum* spp.), and rye (*Secale* spp.) in the raw or uncleaned or un-processed state from the countries and localities above mentioned except on compliance with the following regulations."

The regulations (appended to the Notice) governing the entry of wheat, oats, barley, and rye, relate to the method of making application for import permits, the issue and validity of the permits on approval of the applications, the marking of the bags or other containers of the cereals, the giving of notice by the importers on arrival of authorised consignments, and the conditions of entry of such consignments. Thus last regulation provides that the cereals authorised for importation are not to be released for entry until sterilisation has been carried out by a method approved by the Federal Horticultural Board of the United States Department of Agriculture. Where the prohibited cereals are required to be imported for milling purposes, only the bran, or products containing bran and screenings, shall be subject to sterilisation.

The regulations do not apply to husked or polished rice imported for food purposes.

Specimen application and licence forms, together with a specimen form to be completed by the importer or broker on arrival of authorised consignments, are appended to the regulations.

It has now been decided that the Land Army shall be disbanded by 30th November, by which time the potato harvest should be gathered in. Ever since the Armistice, demobilisation

Disbanding the has been going forward gradually. The
Women's Land Army: 8,000 women who remain to-day will be told
Work done and of the date when the Government organisation
Distinctions conferred. will be withdrawn. At the same time they

will be encouraged to remain as employees of the farmers in the ordinary way, for their labour, invaluable during the War, is wanted in permanence on the farms. The women have been quick to learn all sides of farming operations, and they have been specially successful as milkers and in charge of stock. Starting as they did in the face of much prejudice or scepticism, the women of the Land Army have won for themselves the gratitude of their employers and the admiration of the country.

The first recruits were enrolled in March, 1917. Since that time 43,000 applicants have been interviewed, and 23,000 have been selected and placed. Of the latter, 15,000 received short courses of training. The uniform of the Land Army has given complete satisfaction, and one complete outfit has been issued every six months.

The detailed work has been carried out by the Women's Branch of the Board of Agriculture and its County Committees and office staffs throughout England and Wales.

Two awards of merit were inaugurated in the Land Army on 5th October, 1918. The first is the Good Service Ribbon, which is awarded to all workers who have given six months' completely satisfactory service, both in and out of working hours. Of these ribbons 7,970 have been awarded down to the present.

The second is the Distinguished Service Bar, which is popularly known amongst the girls as the V.C. of the Land Army. It is given for acts of courage and unselfish devotion in the service of others, and also for special skill in the course of their employment. Down to the present 46 Bars have been awarded, and of these 24 were given for deeds of splendid courage and endurance. Twenty-two were awarded for really exceptional skill in such unaccustomed work for women as rearing bulls and driving tractors, and that branch of land work which calls not only for skill but for endurance—shepherding. In this latter class, though the standard is very high, one or two cases stand out from the others. Miss D. S. Macrae has so distinguished herself as a tractor driver that she has been given entire charge of the tractor department of a big firm of contracting engineers in the North. Mrs. Hallam, a shepherdess in Cornwall, has conducted all the shepherding operations entirely alone on a large farm where she has the charge of 200 pedigree sheep. During her second lambing season the crops of lambs beat all previous records, and her farmer says she can throw a sheep better than any man he knows.

The extraordinary way in which these women have adapted themselves to this unusual work is proved in the case of the girl who, formerly an assistant in the ribbon department in a big store in the Midlands, has, since she joined the Land Army, attended to the calving and rearing of prize bulls. These she has led into the sale ring—work which, as her employer himself says, few women would have had courage to undertake and still fewer have been able to carry out so well.

There are also many ploughwomen who, with tractors, have ploughed more acres with less petrol than any man in their county, and one who, with a horse plough, has gained the high distinction of Champion "Ploughwoman" of Wales.

The Distinguished Service Bar: How it has been won by Women of the Land Army.—*Peggy Fisher*.—A cowman who was about to chain up a bull, which was loose in the stall, was knocked down by the animal, which promptly proceeded to gore him. Peggy Fisher rushed in, and, jumping the barrier, attacked the bull by kicking his nose. The bull backed and the man was able to get out. But for Fisher's pluck he would have been seriously injured and probably killed.

Lily Harrison, when a new recruit and quite unused to horses, rescued a young pony that was being viciously attacked and bitten by a hunter. The foreman did not think it was safe to go near, but Harrison managed to separate the animals.

F. E. Henley.—A frightened cow was stranded on a small piece of dry land in the middle of a swift and wide river, unable to reach either bank on account of the soft mud surrounding her. Henley swam across the river, roped the cow in mid stream and drove it before her to the bank.

Jessie Bar saved a number of pigs from drowning. They had run on to a pond which was covered with a thin layer of ice and they all went into the water. Bar climbed a tree overhanging the pond, and, supporting herself from one of the boughs, pulled the pigs out by their tails.

K. Botting rescued a fellow land girl who was being attacked by a boar. At great personal risk she held the boar down with her pitchfork, while the other girl escaped.

In April last Lord Ernle, then President of the Board of Agriculture, appointed a Committee, of which Sir David Prain, F.R.S., was chairman, to inquire and report what steps should be

The Royal Botanical Society of London: Committee's Report.

taken to render the work of the Royal Botanical Society of London as useful as possible from a scientific and educational point of view.* This Committee has now reported. After dealing with the objects of the Royal Botanical Society, which was incorporated in 1839, it points out that a gardening school was established in 1807 and that the Society has provided facilities on many occasions for experimental work in botany and horticulture. It is clear that endeavours were made from time to time to increase the usefulness of the gardens from a scientific point of view, and in 1907 a Committee representing the University of London and the Royal Botanical Gardens published a Report, giving a summary of the facilities of the botanical teaching in London and suggesting that the Botanical Gardens might be made a centre for certain colleges. For reasons the Committee is unable to discover, this Report was not adopted, and the opinion is expressed that there is not now any possibility of concentrating elementary teaching of botany in one place. At the same time the Committee considers that the objects of the inquiry can best be carried out by the establishment of:—

- (a) A School of Economic Botany for the study of economic plants and their products.

* See this *Journal*, May, 1919, p. 208.

- (b) An Institute for Research, especially in plant physiology.
- (c) A centre for teaching in horticulture.
- (d) Classes for "school gardening," for teachers.

The Committee is of opinion that the gardens might be utilised as the centre from which colleges and schools of botany could be supplied with material for teaching and research, and in which students could use existing facilities for the study of systematic botany.

In an Appendix is dealt with the question of the buildings required to carry out the proposed work. The outlay needed for buildings, which should be of a temporary character, equipment, laboratories, books, plants, etc., is reckoned at about £5,000, and the cost of maintenance at £3,000 to £3,500 a year on the basis of present prices.

The total number of outbreaks of Rabies confirmed is now 246, namely, 102 in Devon, 27 in Cornwall, 76 in Glamorgan, 12 in Monmouth,

Rabies. 2 in Gloucester, 7 in Middlesex, 11 in Surrey, 1 in London, 2 in Kent, 1 in Berkshire, 1 in Brecknock, and 4 in Essex.

As from 30th September, the Control of Dogs Orders were withdrawn from (a) Kent, (b) a portion of East Surrey (including Croydon), (c) Cornwall and Devon (except certain areas of about eight miles' radius round St. Tudy (Cornwall) and Plymouth, and (d) portions of Herefordshire and Gloucestershire.

ALL restrictions which were imposed on account of the outbreaks of foot-and-mouth disease in Warwickshire were withdrawn on 21st

Foot-and-Mouth Disease.

September, excepting as regards movement of animals out of a small area immediately surrounding the premises on which the disease had existed, which remain prohibited.

Two further outbreaks have been confirmed in Dorsetshire since the first outbreak on 11th September recorded in the issue of this *Journal* for last month. These occurred on the 13th and 19th September respectively, and were both in close proximity to the original outbreak. The restrictions on movement of animals have been considerably modified, and now apply only to an area of about four miles radius from Wyke Regis.

THE following Notice was issued by the Ministry of Food on 8th October —

The Food Controller announces that he has decided, with the concurrence of the Boards of Agriculture, to purchase British and Irish hard whole-milk cheese for the Pool, manu-

Control of Home Cheese.

factured during October, 1919, and delivered to the Pool on or before the 30th November, 1919, at the maximum first-hand price of 2s 2d. per lb. for Grade 'A' cheese. For cheese placed in Grades "B" and "C" correspondingly lower prices will be paid in accordance with the existing regulations. The Food Controller has also issued a Notice under the British Cheese Order, 1917, including the following complete

schedule of maximum first-hand prices for the various varieties of home cheese (with the exception of Caerphilly) manufactured during October, 1919, and delivered up to and including 30th November, 1919. This Order also provides that the maximum first-hand prices for cheese manufactured up to 30th September, 1919, set out in Notices to the British Cheese Order, 1917, issued on the 10th July and 12th August, 1919 (Statutory Rules and Orders No. 848 and 1007), are still in force, but will now apply to such cheese delivered up to and including 30th November, 1919, instead of up to and including the 31st October, 1919, as previously stated.

The question of purchase for the Pool of hard whole-milk home cheese manufactured after 31st October is still under consideration. An intimation on this matter will shortly be made.

THE SCHEDULE.

Maximum First-hand Prices.

Variety of Cheeses.	Manufactured between 1st October and 31st October, 1919 (inclusive), in Great Britain and Ireland and delivered on or before 30th November, 1919.	
	<i>s. d.</i>	
Ripened Stilton and Wensleydale (blue) ..	2	4
Dorset hand skimmed (blue)	1	10½
Dorset (separated) (blue)	1	6½
Dorset (separated) (white)	1	5
All other whole-milk cheese (except Caerphilly cheese and any whole-milk cheese not exceeding 2 lb. weight uncut)	2	2
All other partially skimmed cheese (i.e., cheese containing at least 25 per cent. of fat in the dry matter)	1	8½
All other wholly skimmed cheese (i.e., cheese containing less than 25 per cent. of fat in the dry matter)	1	5
<hr/>		
	Delivery between 6th October and 8th November, 1919 (inclusive). Manufactured in Great Britain and Ireland.	
	<i>s. d.</i>	
Any whole-milk cheese not exceeding 2 lb. weight uncut, other than Caerphilly ..	2	4

THE *International Crop Report and Agricultural Statistics* for September, 1919, published by the International Institute of Agriculture, gives particulars concerning the production of the cereal crops of 1919 in certain countries in the Northern Hemisphere.

Notes on Crop Prospects Abroad.

Wheat.—The production in Spain, Scotland, Italy, Canada, United States, British India, Japan and Tunis

is estimated at 216,826,000 qr. in 1919, against 229,723,000 qr. in 1918, or a decrease of 5.6 per cent., the area shown showing an increase of 0.1 per cent.

Rye.—The estimated production in Italy, Canada and the United States is placed at 11,261,000 qr. in 1919, or a decrease of 7.1 per cent. compared with 1918, when it amounted to 12,120,000 qr., but the area sown showed an increase of 5.7 per cent.

Barley.—The production in Italy, Canada, United States, Japan and Tunis is estimated to amount to 44,618,000 qr. in 1919, against 52,545,000 qr. in 1918, or a decrease of 15.1 per cent., the area sown being smaller by 6.2 per cent.

Oats.—It is estimated that the total yield in Scotland, Italy, Canada, United States, Japan, and Tunis amounts to 176,540,000 qr. in 1919, against 216,381,000 qr. in 1918, or a decrease of 18.4 per cent., the area sown being smaller by 3.7 per cent.

Maize.—The production in Italy, Canada, and the United States is estimated at 343,739,000 qr. in 1919, against 311,832,000 qr. in 1918, or an increase of 10.2 per cent., while the area sown showed a decrease of 4.0 per cent.

France.—An official estimate gives the out-turn of the crops in 1919 as follows (in quarters and figures for 1918 and 1913 in brackets) — Wheat, 22,250,000 (29,265,000 and 40,000,000); rye, 4,248,000 (3,491,000 and 5,840,000); barley, 2,836,000 (3,372,000 and 5,600,000); and oats, 17,727,000 (19,900,000 and 37,800,000). (*Broomhall's Corn Trade News*, 11th October, 1919.)

Sweden.—According to an official report issued at Stockholm on 12th September, the condition of the crops at the end of August was as follows, last year's figures being given in brackets (5 = very good, 4 = good, 3 = average, and 2 = small):—Wheat, 3.5 (3.0); rye, 3.2 (3.0); barley, 3.6 (3.0); oats 3.6 (3.0); mixed corn, 3.7 (3.1); hay, 3.2 (2.1); and potatoes, 3.4 (3.3). (*Broomhall's Corn Trade News*, 24th September, 1919.)

United States.—The Crop Reporting Board of the Bureau of Statistics of the Department of Agriculture give the following estimates of production based on the condition of the crops on 1st October (in bush. and final official returns for 1918 in brackets):—Winter wheat, 715,000,000 (558,449,000); spring wheat, 203,000,000 (358,651,000); all wheat, 918,000,000 (917,100,000); maize, 2,901,000,000 (2,582,814,000); oats, 1,220,000,000 (1,538,359,000); barley, 198,000,000 (256,375,000); and linseed, 11,000,000 (14,657,000).

The average yield per acre compared with that of 1918 (in brackets) is as follows (in bush.):—Winter wheat, 14.6 (15.2); spring wheat, 9.0 (16.0); all wheat, 12.8 (15.5); maize, 28.2 (24.0); oats, 28.9 (34.6); barley, 22.3 (26.5); and linseed, 5.8 (7.6). (*London Grain, Seed and Oil Reporter*, 8th October, 1919.)

India.—According to the Final General Memorandum issued on 16th August, the total area under wheat in India in 1918-19 is 23,764,000 acres as against 35,487,000 acres last year, or a decrease of 33 per cent., and the total yield is estimated at 35,009,000 qr. as compared with 46,303,000 qr. last year, or a decrease of 24 per cent. (*London Grain, Seed and Oil Reporter*, 17th September, 1919.)

THE corn harvest is now practically finished, except in Wales and other hilly districts. Weather conditions were generally favourable, and the crops were secured in good condition ;

**Agricultural
Conditions in England
and Wales
on 1st October.**

rain, while in some cases causing delay, has done no material harm.

In the more important potato-growing districts the main crop is now being lifted. There is little disease anywhere, although some is reported from the south-western counties, and on the whole the potatoes appear to be unusually healthy. Prospects have improved a little during the month, but the yield on the whole is expected to prove some 7 or 8 per cent. below the average.

Roots have improved during the month, but have by no means recovered from their bad start, and are backward, so that only light crops can be looked for. Turnips and swedes are expected to yield only 83 per cent. and mangolds 70 per cent. of the normal.

Autumn cultivation is proceeding under favourable weather conditions : work appears to be well advanced on the western side of the country, but rather late in the eastern counties. With some exceptions in various parts of the country, the stubbles are described as foul with weeds.

The young seeds are somewhat variable, but nearly everywhere they are thin and unpromising. A good deal of patching with trifolium has been done.

The pastures generally are green for the time of year, but there are several reports to the effect that there is not much grass on them. Live stock have done fairly well, but their general condition can hardly be said to be as good as it should be at this time of year.

Ordinary unskilled labour is mostly reported to be sufficient in quantity, though frequently described as somewhat inefficient : skilled hands of all kinds are still scarce.

The following local summaries give details regarding agricultural labour in the different districts of England and Wales :—

Agricultural Labour *Northumberland, Durham, Cumberland, and Westmorland.*—Generally speaking, the supply of labour has been about sufficient, as crops during September. have been light and the weather favourable.

Lancashire and Cheshire.—Although skilled labour is still somewhat scarce, the general supply is about sufficient, as farmers are using more labour-saving machinery.

Yorkshire.—Labour is more plentiful, but there is still a deficiency of skilled men.

Shropshire and Stafford.—About half the reports indicate that the supply is about sufficient, and the remainder refer to a shortage especially of skilled men—ploughmen, waggoners, stockmen, and thatchers being specially mentioned.

Derby, Nottingham, Leicester, and Rutland.—Skilled men are still short in Derbyshire, but elsewhere the supply of labour is mostly about sufficient for requirements.

Lincoln and Norfolk.—The supply of labour is generally sufficient for requirements, but skilled men are still scarce in some parts.

Suffolk, Cambridge and Huntingdon.—Labour is sufficient.

Bedford, Northampton, and Warwick.—The supply of labour is everywhere about sufficient.

Buckingham, Oxford, and Berkshire.—There is an adequate supply of unskilled labour, but in one or two districts skilled men are scarce.

Worcester, Hereford, and Gloucester.—Labour is generally sufficient, although there is a shortage of skilled hands.

Cornwall, Devon, and Somerset.—Labour is mostly sufficient, but of inferior quality.

Dorset, Wiltshire, and Hampshire.—The supply of labour is sufficient, though the quality is not always of the best.

Surrey, Kent, and Sussex.—Labour conditions vary, but most reports indicate a sufficiency. Skilled labour is rather scarce, and farmers complain of the poor quality of the labour.

Essex, Hertford, and Middlesex.—Labour is fairly plentiful, except in Middlesex and a part of Hertford.

North Wales.—A third of the reporters state that there is a shortage, although not a serious one, but usually the supply is about equal to the demand, which appears to be rather less than usual.

Mid Wales.—There is generally sufficient labour, but skilled men are still needed.

South Wales.—The position as regards the supply of labour has improved somewhat, but skilled men, especially milkers, are still difficult to obtain.

AVERAGE PRICES of British Wheat, Barley, and Oats at certain Markets during the Month of September, 1917, 1918, and 1919.

	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919	1917	1918.	1919.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	73 6	73 7	76 1	60 2	60 6	98 8	50 1	54 11	64 9
Norwich ...	71 9	72 5	72 9	60 4	60 8	90 6	46 0	54 4	63 3
Peterborough ...	69 9	72 0	72 7	56 6	60 0	92 0	41 10	45 3	60 11
Lincoln ...	70 0	72 2	73 8	57 8	60 0	93 8	45 5	54 0	63 5
Doncaster ...	71 11	71 10	73 6	56 4	59 10	98 0	44 7	—	58 5
Salisbury ...	71 11	72 1	73 0	61 2	61 3	91 6	50 5	44 2	61 8

STATEMENT showing the Average Price of **British Corn**, per Quarter (Imperial Measure), for the Quarter ending Michaelmas, 1919, pursuant to the Corn Returns Act, 1882.

<i>Wheat.</i>	<i>Barley.</i>	<i>Oats.</i>
s. d.	s. d.	s. d.
73 3	78 5	56 7

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1917, 1918 and 1919.

Weeks ended (in 1919).	WHEAT.						BARLEY.						OATS.					
	1917.		1918.		1919.		1917.		1918.		1919.		1917.		1918.		1919.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan. 4...	70	0	71	2	72	2	66	4	58	0	62	3	47	1	45	5	48	8
" 11...	75	8	71	2	72	6	65	7	58	2	62	5	47	2	46	9	49	8
" 18...	75	8	71	3	72	7	64	9	58	1	62	3	47	4	47	9	50	0
" 25...	75	10	71	1	72	7	64	5	58	7	61	10	47	8	48	2	49	6
Feb. 1...	75	10	71	2	72	8	64	0	58	10	62	4	47	3	50	2	49	7
" 8...	76	0	72	0	72	7	63	5	59	0	62	3	46	11	50	6	49	2
" 15...	76	3	72	3	72	8	63	8	58	11	62	5	47	3	52	0	49	0
" 22...	76	9	72	2	72	8	63	9	58	9	62	6	47	8	52	3	49	4
Mar. 1...	77	4	72	2	72	7	64	0	57	9	62	7	48	0	52	0	48	8
" 8...	78	0	72	3	72	6	63	7	58	5	62	7	48	7	52	2	48	6
" 15...	78	10	72	4	72	5	64	1	56	10	62	5	49	4	51	0	46	8
" 22...	80	3	72	3	72	7	65	6	56	9	62	1	50	4	50	3	46	4
" 29...	81	5	72	4	72	7	71	10	56	7	62	8	51	10	48	10	46	11
Apl. 5...	84	4	72	11	72	6	69	11	56	7	62	8	55	1	49	10	47	2
" 12...	85	2	73	3	73	0	71	10	56	6	62	9	57	2	47	2	47	1
" 19...	84	10	73	3	73	1	70	6	56	6	62	9	59	8	47	0	47	3
" 26...	81	1	73	3	73	1	69	5	56	10	62	9	58	6	46	8	48	1
May 3...	77	7	73	5	73	2	64	4	56	5	62	8	54	9	47	4	48	7
" 10...	78	0	73	5	73	2	64	11	56	6	63	1	55	2	47	6	47	5
" 17...	77	11	73	4	73	3	64	10	56	6	62	4	55	2	46	4	47	11
" 24...	78	0	73	3	73	2	64	9	56	6	62	7	54	11	47	8	47	11
" 31...	78	0	73	8	73	3	65	11	60	0	62	7	54	11	44	9	48	3
June 7...	78	0	73	11	73	2	67	7	59	2	62	6	55	0	45	5	47	10
" 14...	78	2	74	3	73	3	75	6	57	9	62	8	55	1	45	7	48	11
" 21...	78	1	74	4	73	3	75	0	58	5	62	8	55	2	47	8	48	7
" 28...	78	3	74	4	73	3	73	11	57	10	63	4	55	1	46	4	49	1
July 5...	78	1	74	4	73	4	69	5	61	7	62	4	55	2	46	10	49	0
" 12...	78	2	74	4	73	3	70	10	57	5	63	1	55	1	47	0	49	11
" 19...	78	3	74	3	73	4	72	1	60	5	62	9	55	2	45	4	49	11
" 26...	78	3	74	3	73	4	65	7	56	11	63	4	55	2	46	2	48	11
Aug. 2...	78	2	74	3	73	3	73	6	57	1	62	10	55	0	45	10	50	3
" 9...	78	4	74	7	73	4	76	1	57	7	73	8	55	0	46	3	55	6
" 16...	78	7	74	2	73	3	68	11	61	4	75	2	55	6	55	11	61	4
" 23...	76	7	74	8	73	10	70	7	62	6	83	4	54	7	56	9	62	0
" 30...	72	1	74	8	73	3	60	4	60	1	86	7	49	0	57	11	61	10
Sept. 6...	71	6	72	3	73	4	59	3	60	4	89	3	46	7	56	9	61	1
" 13...	70	7	72	5	73	5	57	2	60	1	92	5	45	0	49	2	62	4
" 20...	70	8	72	6	73	4	56	10	60	4	94	7	45	8	49	11	61	3
" 27...	70	6	72	7	73	0	58	5	60	3	95	2	44	7	50	3	60	2
Oct. 4...	70	8	72	8	73	4	57	9	60	3	94	4	44	9	50	9	59	6
" 11...	71	0	72	6			58	5	60	3			44	5	51	6		
" 18...	70	8	72	7			59	3	60	3			44	1	50	9		
" 25...	70	10	72	5			60	1	60	3			43	0	50	5		
Nov. 1...	70	4	72	4			59	11	60	3			42	4	50	8		
" 8...	70	3	72	4			60	2	60	3			42	11	49	11		
" 15...	70	3	72	5			60	2	60	3			43	0	49	10		
" 22...	70	2	72	4			59	9	60	10			43	1	51	1		
" 29...	70	2	72	3			59	3	62	2			44	6	50	4		
Dec. 6...	70	7	72	4			58	7	62	6			43	5	51	4		
" 13...	71	2	72	3			58	0	62	7			43	6	51	4		
" 20...	71	1	72	4			57	7	62	3			44	2	50	5		
" 27...	71	1	72	3			57	7	62	3			44	10	50	6		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in September and August, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	SEPTEMBER.		AUGUST.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.
FAT STOCK :—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Cattle :—				
Polled Scots	79 2	74 0	79 3	74 2
Herefords	79 0	73 8	78 7	73 10
Shorthorns	78 8	73 9	78 7	73 10
Devons	78 6	73 10	78 4	73 5
Welsh Runts	77 8	73 8	78 0	74 6
Fat Cows	73 9	65 9	73 9	65 9
	First Quality. per lb.*	Second Quality per lb.*	First Quality. per lb.*	Second Quality. per lb.*
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
Veal Calves	10½	9	10½	9
Sheep :—				
Downs	14½	14½	14½	14½
Longwools	14½	14½	14½	14½
Cheviots	14½	14½	14½	14½
Blackfaced	14½	14½	14½	14½
Welsh	14½	14½	14½	14½
Cross-breds	14½	14½	14½	14½
	per score. live weight	per score. live weight	per score. live weight	per score. live weight
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Pigs :—				
Bacon Pigs	21 0	21 0	21 0	21 0
Porkers	21 0	21 0	21 0	21 0
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>
Shorthorns—In Milk ...	53 8	39 11	50 12	36 15
" —Calves ...	49 15	37 15	47 15	36 2
Other Breeds—In Milk ...	45 4	33 4	45 13	32 2
" —Calves ...	32 0	26 10	29 10	27 0
Calves for Rearing	3 6	2 8	3 9	2 10
Store Cattle :—				
Shorthorns—Yearlings ...	15 11	12 17	15 17	13 0
" —Two-year-olds...	26 14	21 12	26 6	21 15
" —Three-year-olds	37 0	31 7	34 15	30 4
Herefords—Two-year-olds...	26 9	21 5	26 0	22 15
Devons— " ...	28 3	23 17	28 1	22 11
Welsh Runts— " ...	—	21 0	—	—
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Downs or Longwools ...	58 10	49 0	61 7	48 8
Store Pigs :—				
8 to 12 weeks old	56 3	41 2	60 11	44 11
12 to 16 " "	94 5	74 0	98 8	79 11

* Estimated carcass weight.

NOTE.—The prices per lb for sheep do not include the value of the skins or pelts, which during September made prices equivalent to an additional 1½d. per lb. of the carcass weight for Downs, Longwools, and Welsh, 2½d. for Cheviots and 2d. for Blackfaced and Crossbreds, and during August, 1½d. per lb for Downs, Longwools, Blackfaced, Welsh and Crossbreds, and 1½d. for Cheviots.

**AVERAGE PRICES of PROVISIONS, POTATOES and HAY at
certain MARKETS in ENGLAND in September, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER :—	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.	<i>s. d.</i> per 12 lb.
British	—	—	—	—	27 6	—
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
„ Factory	—	—	—	—	—	—
Imported (Controlled)	252 0	—	252 0	—	252 0	—
CHEESE :—						
British—						
Cheddar	144 6	—	—	—	144 6	—
Cheshire	—	—	120 lb. 155 0 per cwt.	—	120 lb. 155 0 per cwt.	—
Canadian	144 6	—	144 6	—	144 6	—
BACON :—						
Irish (Green)	195 6	—	195 6	—	195 6	—
Canadian (Green sides)	190 6	—	192 6	—	195 0	—
HAMS :—						
York (Dried or Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green) (long cut)	193 6	—	115 6	—	195 0	—
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	47 8	45 0
Irish	43 0	—	42 0	40 0	43 0	41 0
American	—	—	31 9	29 9	33 0	31 0
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
White Kidney	215 0	200 0	265 0	230 0	236 6	216 6
Other First Earlies	236 6	205 0	260 0	233 6	223 6	206 6
British Queen... ..	220 0	205 0	256 6	225 0	206 6	190 0
HAY :—						
Clover	—	—	—	—	—	—
Meadow	—	—	—	—	—	—

**AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in September, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.				Quality.	Birming- ham.	Leeds.	Liver- pool.	London.	Man- chester.
					per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—									
English	...	...	...	1st	119 0	119 0	—	119 0	119 0
				2nd	119 0	119 0	—	119 0	119 0
Cow and Bull	...	...	...	1st	119 0	119 0	119 0	119 0	119 0
				2nd	119 0	119 0	100 6	105 0	100 6
Irish : Port Killed	...	...	...	1st	—	—	119 0	119 0	—
				2nd	—	—	119 0	119 0	—
Argentine Frozen—									
Hind Quarters	...	...	...	1st	111 0	111 0	111 0	111 0	111 0
Fore "	...	...	...	1st	71 0	71 0	71 0	71 0	71 0
Australian Frozen—									
Hind Quarters	...	...	...	1st	111 0	—	—	—	111 0
Fore "	...	...	...	1st	71 0	—	—	—	71 0
Brazilian Frozen—									
Hind Quarters	...	...	...	1st	111 0	111 0	—	109 0	—
Fore "	...	...	...	1st	71 0	71 0	—	69 6	—
VEAL :—									
British	...	...	...	1st	60 6	—	—	77 0	—
				2nd	—	74 6	—	58 6	—
MUTTON :—									
Scotch	...	...	...	1st	126 0	126 0	126 0	126 0	126 0
				2nd	126 0	126 0	126 0	126 0	126 0
English	...	...	...	1st	126 0	126 0	—	126 0	126 0
				2nd	126 0	126 0	—	126 0	126 0
Irish : Port Killed	...	...	...	1st	—	—	—	—	—
				2nd	—	—	—	—	—
Argentine Frozen	...	...	...	1st	98 0	98 0	98 0	98 0	98 0
New Zealand "	...	...	...	1st	—	—	—	98 0	98 0
Australian "	...	...	...	1st	—	—	—	98 0	98 0
LAMB :—									
British	...	...	...	1st	126 0	126 0	126 0	126 0	126 0
				2nd	126 0	126 0	126 0	126 0	126 0
New Zealand	...	...	...	1st	98 0	98 0	98 0	98 0	98 0
Australian...	...	...	...	1st	—	—	—	98 0	98 0
Argentine...	...	...	...	1st	98 0	98 0	98 0	98 0	98 0
PORK :—									
British	...	...	...	1st	—	—	149 6	149 6	149 6
				2nd	—	—	—	—	—
Frozen	...	...	...	1st	—	—	—	133 0	—

DISEASES OF ANIMALS ACTS 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	SEPTEMBER.		NINE MONTHS ENDED SEPTEMBER.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	15	13	151	189
Animals attacked	24	17	198	219
Foot-and-Mouth Disease :—				
Outbreaks	3	1	28	1
Animals slaughtered as diseased or exposed to infection ...	38	8	1,593	8
Glanders (including Farcy) :—				
Outbreaks	1	2	20	25
Animals attacked	4	5	50	70
Parasitic Mange :—				
Outbreaks	138	120	4,197	3,569
Animals attacked	271	197	8,467	6,729
Rabies :—				
Number of cases	4	8	146	8
„ „ Dogs affected	4	7	143	7
„ „ other animals affected	—	1	3	1
Sheep-scab :—				
Outbreaks	5	8	225	260
Swine Fever :—				
Outbreaks	165	70	1,707	1,065
Swine slaughtered as diseased or exposed to infection ...	106	27	793	428

IRELAND

(From the Returns of the Department of Agriculture and Technical
Instruction for Ireland.)

DISEASE.	SEPTEMBER.		NINE MONTHS ENDED SEPTEMBER.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	—	—	—	2
Animals attacked	—	—	—	2
Glanders (including Farcy) :—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Parasitic Mange :—				
Outbreaks	3	5	126	92
Sheep-scab :—				
Outbreaks	14	19	186	222
Swine Fever :—				
Outbreaks	4	5	29	22
Swine slaughtered as diseased or exposed to infection ...	18	14	92	72

The Weather in England during September.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours
<i>Week ending 6th Sept.:</i>								
England, N.E. ...	58·6	+2·7	0·61	16	+5	4	3·6	-1·4
England, E. ...	60·6	+2·8	0·23	6	-6	2	5·5	+0·2
Midland Counties ...	58·4	+1·8	0·69	18	+6	5	3·1	-1·7
England, S.E. ...	60·9	+2·1	0·57	15	0	3	5·1	-0·6
England, N.W. ...	57·7	+1·4	0·90	23	+7	5	4·5	-0·6
England, S.W. ...	58·2	+0·7	0·81	21	+4	5	4·4	-0·9
English Channel ...	60·4	0·0	1·40	35	+21	3	6·3	+0·1
<i>Week ending 13th Sept.:</i>								
England, N.E. ...	60·0	+5·0	0·23	6	-1	2	5·9	+0·9
England, E. ...	62·7	+5·9	0·01	0	-9	1	7·8	+2·4
Midland Counties ...	60·2	+4·5	0·25	6	-2	2	6·0	+1·3
England, S.E. ...	63·1	+5·2	0·00	0	-8	0	8·4	+2·7
England, N.W. ...	58·8	+3·0	0·13	3	-10	2	5·4	+0·6
England, S.W. ...	60·9	+4·1	0·09	2	-10	2	6·0	+0·7
English Channel ...	63·6	+3·9	0·01	0	-11	1	8·0	+1·4
<i>Week ending 20th Sept.:</i>								
England, N.E. ...	51·0	-2·7	0·27	7	-2	3	4·2	-0·1
England, E. ...	53·9	-1·6	0·26	7	-2	3	4·2	-0·8
Midland Counties ...	51·9	-2·3	0·27	7	-3	3	4·0	-0·2
England, S.E. ...	55·5	-0·9	0·32	8	-2	2	5·1	-0·2
England, N.W. ...	52·3	-2·1	0·32	8	-6	3	5·3	+1·0
England, S.W. ...	55·0	-0·7	0·35	9	-5	3	3·5	-1·4
English Channel ...	59·7	+0·9	0·49	12	0	3	5·2	-1·3
<i>Week ending 27th Sept.:</i>								
England, N.E. ...	50·5	-2·3	0·38	10	-2	4	5·1	+1·0
England, E. ...	50·7	-3·2	0·32	8	-6	3	4·2	-0·5
Midland Counties ...	50·7	-2·1	0·44	11	-2	3	4·6	+0·5
England, S.E. ...	52·7	-2·5	0·48	12	-3	4	3·3	-1·5
England, N.W. ...	51·0	-2·1	1·00	25	+5	5	4·5	+0·7
England, S.W. ...	52·1	-2·3	0·63	15	-6	5	4·7	+0·5
English Channel ...	55·5	-2·1	0·31	8	-11	5	3·7	-1·3

1 inch = 25·4 millimetres.

ADDITIONS TO THE LIBRARY.

Dairying and Food, General—

Yeld, Ellen.—Practical Cheesemaking. (5th edition.) (55 pp.) Leominster, 1919. 2s. net. [63.7 (02).]

Scottish Milk Records Association.—Report on Milk Records for Season 1917. Register of Class I. Cows. (343 pp.) The Association, Alloway Street, Ayr, 1918. 7s. net. [63.711 (b).]

Williams, R. Stenhouse.—The Milk Industry. (73 pp.) [Journal of the Farmers' Club, May, 1919.] London: Farmers' Club, 1919. 6d. [63.7 (42); 63.70 (04).]

Macnutt, J. S.—The Modern Milk Problem. (258 pp.) New York and London: The Macmillan Company, 1919. 10s. 6d. net. [614.32.]

Veterinary Science—

Karslake, F.—Rabies and Hydrophobia: Their Cause and Prevention. (68 pp.) London: W. & G. Foyle, 1919. 1s. net. [619.7(a).]

Birds, Poultry and Bees—

Donaldson, H. H.—The Rat: Date and Reference Tables for the Albino Rat (*Mus Norvegicus Albinus*) and the Norway Rat (*Mus Norvegicus*) [Memoirs of the Wistar Institute of Anatomy and Biology.] (278 pp.) Philadelphia, 1915. [63.269.]

Martin, P. H.—L'Oeuf de Poule et L'Incubation Artificielle. (96 pp.). Paris: J. B. Baillière et Fils, 1919. 3 fr. [63.651(64).]

Departmental Committee on the Protection of Wild Birds.—Minutes of Evidence together with Appendices. (193 pp.) [Cmd. 189.] London: H.M. Stationery Office, 1919. 1s. 9d. net. [59.162.]

Forestry—

Mattern, J. R.—The Use of Explosives in the Tillage of Trees. (78 pp.) New York: Institute of Makers of Explosives, 1918. [63.190; 63.49-19]

Black, R.—Canada's Forests as an Imperial Asset. (16 pp.) Ottawa: Canadian Forestry Association, [1919.] [63.49(71).]

Buhler, A.—Der Waldbau nach wissenschaftlicher Forschung und praktischer Erfahrung. Band I. (662 pp.) Stuttgart: Eugen Ulmer, 1918. [63.49(621).]

Canada, Commission of Conservation.—Forests of British Columbia. (409 pp. + 21 maps.) Ottawa, 1918. [63.49(71).]

Stebbing, E. P.—Commercial Forestry in Britain. Its Decline and Revival. (186 pp.) London: John Murray, 1919. 6s. net. [63.49(42).]

Webster, A. D.—National Afforestation. (166 pp.) London: T. Fisher Unwin, 1919. 6s. net. [63.42.]

Engineering—

Thresh, J. C.—Housing of the Agricultural Labourer with special reference to the County of Essex. (81 pp.) London: Rural Housing and Sanitation Association. 6d. net. [333.32.]

Bullard, F.—Concrete for House, Farm and Estate. (49 pp. + 52 figs.). London: Crosby, Lockwood & Son, 1919. 3s. 6d. net. [69(02).]

Eckblaw, K. J. T.—Farm Concrete. (295 pp.) New York and London: The Macmillan Company, 1917. 8s. 6d. net. [69(02).]

Turpain, A.—Vers la Houille Blanche: Moto-culture et Electro Moto-culture (76 pp.) Paris: H. Dunod et E. Pinat, 1919. 2 fr. 50 + 20 per cent. [63.17(64).]

Lawrence, C. P.—Economic Farm Buildings. Systematic Planning, Improvement and Construction (180 pp.) London: Library Press, 1919. 10s. 6d. [69(02).]

Concrete Utilities Bureau.—Pamphlet 13.—Concrete for Farm and Estate, Home and Garden, Town and Country, Road and Railway (48 pp.) London: The Bureau, 6, Lloyd's Avenue [1919]. [69(04).]

Economics—

Malcolmson, V. A.—The Economic Future of Agriculture. (57 pp.) [Journal of the Farmers' Club, April, 1919.] London: Farmers' Club. 6d. [338.1.]

"*Law Notes*" (Edit.).—Increase of Rent and Mortgage Interest (Restrictions) Acts, 1915-19. (75 pp.) [Fourth Edition.] London: "Law Notes," 1919. 3s. 6d. net. [336.6.]

Oettinger, J.—Jewish Colonization in Palestine: Methods, Plans, and Capital. London: Jewish National Fund, 15, New Broad Street, E.C. 2s. [63(5); 325.]

Ministry of Reconstruction.—Pamphlet 20:—Land Settlement. (16 pp.) London: H.M. Stationery Office, 1919. 2d. net. [325.]

Day, H. A.—The Land Question Solved. (92 pp.) London: Methuen and Co., 1919. 2s. 6d. net. [333.5; 338.1.]

Adams, A. B.—Marketing Perishable Farm Products. (180 pp.) [Columbia University, Studies in History, Economics, etc. Vol. LXXII. No. 3.] New York: Columbia University [London: Longmans Green & Co., 1916.] \$1.50. [381.]

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

- Physiological Pre-determination: The Influence of the Physiological Condition of the Seed upon the Course of Subsequent Growth and upon the Yield: III. and IV., Review of Literature. Chap. II. and III. *F. Kidd* and *C. West*. (Ann. App. Biol., April, 1919.) [63.1951.]
- Decomposition of Cyanamide and Dicyanodiamide in the Soil. *G. A. Cowie*. (Jour. Agric. Science, April, 1919.) [63.1671.]
- Agricultural Chemistry, *E. J. Russell*. (Ann. Rep. Soc. Chem. Indust. on Progress of Applied Chemistry, 1918.) [54(64).]
- Die Verhinderung der Verflüchtigung von Ammoniumstickstoff durch Chlorcalcium, *A. Stutzer*. (Pflügers Land. Zeitung 1/15 Februar, 1919.) [63.1623.]
- Die Selbsterhaltung lagernder Pflanzenmassen mit besonderer Berücksichtigung von Heu und Emd. *R. Burri*. (Land. Jahrb. Schweiz, Heft 1, 1919.) [63.198.]
- Agricultural Chemistry and Vegetable Physiology, *E. J. Russell*. (Ann. Rep. Progress. Chem., 1918.) [58.11; 63.161.]
- The Phosphate Industry. *J. Hendrick*. (Jour. Soc. Chem. Indust., May 15th, 1919.) [63.1672.]
- Rural Economy of France, *H. M. Conacher*. (Scott. Jour. Agric., April, 1919.) [63(44).]

Field Crops—

- On Forms of the Hop (*Humulus lupulus*, L.) resistant to Mildew (*Sphaeria theca humuli* (D.C.) Burr.) ; III., *E. S. Salmon*. (Ann. App. Biol., April, 1919.) [63.345.]
- Flax. Cultivation, Preparation, Spinning, Weaving, *W. Norman Boase*. (Jour. Roy. Soc. Arts, May 2nd, 1919.) [63.34111.]

Plant Diseases—

- The Structure, Bionomics and Forest Importance of *Cryphalus Abutis* Ratz. *W. Ritchie*. (Ann. App. Biol., April, 1919.) [63.27, 63.27-49.]
- A Copper Emulsion as a Fungicide *H. Wormald* and *L. K. Wormald*. (Ann. App. Biol., April, 1919.) [63.295.]
- Investigations on Potato Diseases. *G. H. Pethybridge*. (Dept. Agric. and Tech. Instruc., Ireland, Jour., May, 1919.) [63.24-33.]
- Seed Disinfection by Formaldehyde Vapor, *C. C. Thomas*. (Jour. Agric. Research, April 15th, 1919.) [63.1951, 63.294.]

Live Stock—

- The Rancidity of Palm Kernel and other Feeding Cakes, *J. R. Furlong*. (Jour. Agric. Science, April, 1919.) [63.604(a).]
- Mat Production, *J. Alan Murray*. (Jour. Agric. Science, April, 1919.) [612.394.]
- Net Energy Values and Starch Values, *H. P. Armsby* and *J. A. Fries*. (Jour. Agric. Science, April, 1919.) [612.394, 63.604.]
- Quantity and Composition of Ewes' Milk: Its Relation to the Growth of Lambs, *R. E. Neudig* and *E. J. Iddings*. (Jour. Agric. Research, April 15th, 1919.) [63.63(64).]

Birds, Poultry, and Bees—

- Isle of Wight Disease in Hive Bees, *J. Rennie* and *Elsie J. Harvey*. (Scott. Jour. Agric., April, 1919.) [63.81.09.]
- Women's Sphere in the Poultry Industry, *L. Murphy*. (Dept. Agric. and Tech. Instruc., Ireland, Jour., May, 1919.) [63.651(64).]

Forestry —

- The Prospects of starting State Forestry, *Rt. Hon. F. D. Acland* (Contemporary Rev., April, 1919.) [63.49(42).]
- Wald und Waldwirtschaft in Belgien, *Jentsch*. (Tharandter Forst. Jahrb., 70 Band, 2 Heft, 1919.) [63.49(493).]

Economics—

- Notes on the Report of the Agricultural Policy Sub-Committee of the Reconstruction Committee, *J. H. Sabin*. (Surveyors Inst. Trans., April 28th, 1919.) [338.98.]

THE JOURNAL OF THE BOARD OF AGRICULTURE

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NOVEMBER, 1919.

EDITORIAL NOTES.

THE Prime Minister's speech, postponed on account of the railway strike, was delivered before a representative audience on the 21st of last month. The speech is printed in extenso on pp. 772—789, and its bearings on agriculture have been so thoroughly canvassed that little more than recapitulation of the salient points is needed here. The Premier contended that agriculture is the greatest of our State industries; he reminded his hearers that it had been stimulated by the pressure of war, and he assured them that the task of statecraft is to see that it does not fall back to its earlier perilous position. After reminding an audience representative of every interest associated with agriculture that so far as tillage is concerned we are still 3,000,000 acres behind the standard of 1870, he pointed out that if arable farming is to be extended or even maintained, in the national interest there must be guaranteed minimum prices for wheat and oats extended over a sufficient period of years to protect the producer against the possibility of disastrous losses. The farmer is to be secured from the effects of violent fluctuation in the prices of foreign cereals, and the guarantee is to take into consideration the increased cost of production. The amount of the guarantee and the length of time it is to endure are under consideration by the Royal Commission. There must also be a security of tenure that will save the farmer who is a good cultivator from capricious eviction or unreasonable disturbance. Landlord, farmer and agricultural labourer are all entitled to consideration; the Premier pleaded for the co-operation of all three classes with each other and with the State. Mr. Lloyd George made it clear that the condition of guarantees is and must be efficient

farming, and that farmers are expected to keep their methods well abreast of latter-day requirements. He pointed out that it was German agriculture that enabled Germany to maintain the struggle for over four years and that Denmark has increased her corn and other crops by 250 per cent. since the year when the decline of arable farming was first to be noted in England. He exonerated landowners from any charge of profiteering, and urged the labourer, whose case he had always maintained, not to drive too hard a bargain with regard to his hours of labour. Finally, he had something to say about the needs of transport, which, he pointed out, must be associated with co-operation, and he concluded with a vivid picture of rural England "ringing with cheerful life." The speech made an excellent impression. It is worthy of note that the principle of maintaining the Corn Production Act and giving the farmers security has been approved by organs of public opinion which, before the War and the submarine campaign had changed their views, were inspired by an honest, if mistaken, belief that it was not necessary for England to be self-supporting.

The new Agricultural Policy of the Government, outlined by the Prime Minister, was explained in fuller detail by Lord Lee of Fareham, the President of the Board, at Gloucester, on 10th November. His speech is printed in full on pp. 790-805 of this issue of the *Journal*.

HERALDED by a Press campaign of great vigour and enthusiasm, the first National Rat Week was held between the 20th and 27th October. Less than was

Rat Week. hoped, but more than was expected, has been accomplished. While a certain number of counties and metropolitan boroughs were unable through their official representatives to realise the importance of the work they were asked to do, the response to the appeal of the Board of Agriculture was on the whole distinctly favourable, particularly in great seaport towns like London, Bristol and Liverpool, which are exposed at all times and in all seasons to invasion by plague-bearing rats. Poison was the chief agent employed, and the public heard of as many as 570,000 baits being put down in one city. It is a matter for congratulation that vigorous and widespread warnings availed to bring about a very careful handling of all the poisons used. While estimates made at the present moment must partake largely of the nature of conjectures, it is safe to say that the "bag" of

seen and unseen victims must run into seven figures, and the profit to the country into very many thousands of pounds. During Rat Week the Bill for the Destruction of Rats and Mice received its Second Reading in the House of Commons and passed through Committee; it received its Third Reading on 31st October, and at the time of writing is before the Lords. We may hope that something a little more effective than persuasion will soon be applied to recalcitrant authorities.

AN epidemic of Foot-and-Mouth disease has created serious concern among stock breeders throughout the country and engaged the very close consideration of the Board of Agriculture. The trouble started near Ripon in Yorkshire on the 9th January (1919), several cases being confirmed, and was next heard of in Leeds on the 24th February and near Huddersfield on the 11th March, there being a certain amount of evidence to connect these cases with the Ripon outbreak. Both at Ripon and near Huddersfield the prompt action taken stamped out the disease. On the 6th August, at Kingsbury in Warwickshire, a case of Foot-and-Mouth disease was confirmed. There were six outbreaks in this district, the last being confirmed a fortnight after the first. Again the measures taken by the Board were effective. On 11th September, at Wyke Regis, near Weymouth in Dorsetshire, three outbreaks were confirmed, and prompt action had the best possible result. On 17th October, two outbreaks were confirmed at Lawford Heath, near Rugby. Three days later there was an outbreak at Great Gransden in Huntingdonshire; a day later one was confirmed at Bourn in Cambridgeshire. An extension at Lawford Heath was notified and confirmed on the 24th October, while on the 28th, 30th and 31st, outbreaks were reported and confirmed at Horsington and Martin Dales in Lincolnshire. The most serious outbreak of all was reported from the Isle of Wight and confirmed on the 21st October. The outbreaks here have been many; two and twenty had been confirmed down to 4th November, and the loss to the Island herds is appreciable. From first to last the policy of slaughter has been maintained in a persistent endeavour to prevent the spread of the disease, and strenuous effort has been made by the Board to bring home to every farmer the necessity of instant notification to the police. All owners of live stock are reminded that they receive for slaugh-

tered animals their full value. This is estimated on a health basis if they were diseased, and on their market value at the time of slaughter if they were killed merely because they came in contact with affected animals. The special matter for uneasiness associated with the present outbreak is that infection does not appear to come from one direction but from several, and there is no indication of its origin.

AS TO INCREASED PRICE OF JOURNAL, see p. 850.

PRIME MINISTER'S ADDRESS TO AGRICULTURISTS.

AT a meeting of agriculturists held under the auspices of the Board of Agriculture and Fisheries at Caxton Hall, Westminster, on Tuesday, 21st October, 1919, the Prime Minister made a pronouncement on the Government's agricultural policy. The President of the Board (the Right Honourable Lord Lee of Fareham, G.B.E., K.C.B.), was in the Chair.

Among those present on the platform were Sir A. Griffith-Boscawen, M.P. (Parliamentary Secretary to the Board of Agriculture and Fisheries); The Right Hon. Robert Munro, K.C., M.P. (Secretary for Scotland); Lord Bledisloe, K.B.E., The Earl of Coventry; Captain the Hon. F. E. Guest, D.S.O., M.P. (Joint Parliamentary Secretary to the Treasury); Sir J. Fortescue Flannery, Bart., M.P.; Colonel the Hon. E. A. Fitzroy, M.P.; Colonel the Right Hon. F. B. Mildmay, M.P.; Colonel A. Weigall, M.P.; Mr. Leslie Scott, K.C., M.P.; Captain Sir Beville Stanier, Bart., M.P.

The CHAIRMAN, in introducing the Prime Minister, said: I believe it is an historical fact that there has not been in the lifetime of anyone in this room an agricultural speech addressed to an agricultural audience by the head of the Government. That is something of an event. I also believe that there has been no head of the Government who has been more closely connected in one sense with the soil than our present Prime Minister. He was born and bred close to it; he knows something of its difficulties and its trials from the inside. I can answer for this, that his sympathies—and something more than his sympathies—are very much with

agriculture at the present time. I also believe that he is all out to promote the development and the prosperity of agriculture. If I had not thought so, I should not have wished to accept my present position. I think I may perhaps go farther and say that if he had not meant business, I doubt if his choice of a new Minister of Agriculture would have fallen upon me. I will only add that I feel sure that, quite apart from his sympathies with the industry, you will give him a welcome which will be commensurate with the supreme and unsurpassable services which he has rendered, not merely to his native country during the War, but to the whole civilised world.

THE PRIME MINISTER: I come here not merely on behalf of myself, but on behalf of the Government, to redeem a pledge which I gave to a very important deputation of the agricultural members of the House of Commons. I promised that during the recess I would take the first opportunity to address an audience representing the agricultural interests of the country, and to place before them the policy of His Majesty's Government in reference to agriculture. It had been my intention to address that meeting some time ago, but there was an unfortunate incident which interposed, for which I was not in the least responsible—I mean the railway strike—and that necessitated the putting off of a meeting which had already been arranged.

I am very glad now that I have this opportunity of addressing this very representative and influential gathering, representing all sections of agriculture. I think it is a perfectly unique gathering in that respect. It represents every interest that is directly associated with the great industry—the landowner, the land agent, the farmer, and the labourer; and the State Departments connected with agricultural development also are represented. So you have every interest connected with the agricultural industry directly represented in this gathering. Although if one were to read the political history of this country during the last few generations one would hardly think so, the agricultural industry is the greatest industry in the land. It is not altogether what it has been. Relatively to other industries, even in comparison with what it was in the past itself, the agricultural industry does not bear the same share as it formerly did in the prosperity of the land, and that is the condition of things we want to restore, or rather to repair. Notwithstanding that fact, from every point of view it is the greatest of our industries. Take the numbers of those engaged

in it ; take the populations directly dependent upon it ; take its importance from the point of view of the security of the State ; take the fact that the agricultural industry has been the prolific nursery from which other industries in the land are drawn—men virile, strong, who have brought endurance and nerve for the building up of those great industries ; take all these tests, and I say that even to-day the agricultural industry is the greatest industry in the State. It ought, therefore, to be a primary concern of every Government and of every statesman to do what in them lies to help and promote that industry. I regret to say—and I am afraid it is a statement which no one can contradict ; I wish they could—that in no civilised country has the State done so little during the last generations to foster agriculture. You have only to look at the records of others lands, even new countries where you have got virgin soil, and you will find that the State in all these countries has consistently for years and years done things to assist agriculture which we have only been feebly imitating. I hope that record will now be rolled up, and that there will begin a new era in the relations of the State with the greatest and the most important of its industries.

Since 1871 the number of people engaged in the cultivation of the soil has gone down by 700,000—600,000 men, I believe. That means that you have probably a population of about 3,000,000 less than you had at the date directly associated with agriculture. That in itself is a loss to the State. The men engaged in agriculture—especially the young men—have been streaming to the towns, to the industrial centres, where they pursue their avocations under much more unhealthy conditions, and, especially, where they have brought up their children under much more unhealthy conditions. They have been passing across the seas to other lands to give new strength to other countries. That has been a serious, an almost irreparable, loss to this country. Had it not been for the shock of war—the shock of a great war—that process might have continued. But we discovered during four or five years of gripping, terrible conflict, that this neglect of an essential industry had brought this land to the very verge of a great disaster. I say so as one who had a good deal to do with the direction of the War during four or five years, and who, during the last two or three years, was placed in chief direction so far as the Government of this country was concerned. I can tell you that I shall never forget the year 1917—especially the early months—and even in 1918 our anxieties were great. If you read what that great

American sailor Admiral Sims—one to whom the Allies owe so much for his friendly and effective co-operation with our Fleet—if you read what he says about the anxious days of 1917 and how near we came to a great catastrophe, you will realise how this country might have been punished beyond measure by its persistent neglect of the industry upon which the food of the people depended. I could not, as one who was associated with the conduct of the War in those days, remain responsible another year without taking every measure that is necessary in order to make it impossible that there should be a repetition of those perils in the story of our native land. I remember in those days how sorry I was that our great foe had not imitated our example in reference to agriculture. I wished in my heart they had pursued the same course. I tell you now if Germany had pursued the same agricultural policy as we had pursued, and neglected her agriculture as we had neglected ours, she would have collapsed within a year. She would have been unable to replenish her armies; she certainly would have been unable to feed her population; and it is because she did not do so that, in spite of the Blockade, with a much poorer soil than our soil, she was able to hold out for over four years in a dire struggle.

I will give you one or two figures showing what the result has been of the great efforts made by Germany to increase the production of a comparatively poor soil. Do not forget that German soil will not bear comparison for a moment in natural fertility with that of this country. Take 100 acres of cultivated land in this country and 100 acres in Germany—arable and pasture. Britain feeds 45 to 50 persons out of that 100 acres; Germany feeds 70 to 75. Britain grows 15 tons of corn; Germany 33 tons. Britain grows 11 tons of potatoes; Germany 55 tons. This is 100 acres. Now I know it is said that if you go on cultivating potatoes and grain, and devoting the whole of your strength and your soil to that purpose, then meat and milk will suffer. Let me give you the next figures. Britain produces 4 tons of meat to Germany's $4\frac{1}{4}$ tons. Britain produces the equivalent of $17\frac{1}{2}$ tons—it is all marked in tons—of milk to Germany's 28. Britain produces no sugar, and Germany produces $2\frac{3}{4}$ tons. Those are the figures of comparison of what Germany with her soil makes out of 100 acres, with the figures of what Britain with her richer land makes out of hers. The story of Denmark is even a more remarkable one. I gave you the figure of 1871 for this country, showing how our agriculture had gone down since 1871 in the number of

people engaged on the soil. It has gone down very considerably in what the land produces. In Denmark, on the other hand, since 1871, the corn and other crops have increased $2\frac{1}{2}$ times; the total head of cattle increased twice in number; the milch cows—I have only got 1888, I have not got 1871—but since 1888 there has been an increase of nearly 40 per cent. in the milch cows; and in the pigs there is an increase of $4\frac{1}{2}$ times. Those are very remarkable figures, and they show what can be done if you get a real partnership between the State and an industry where the State helps without meddlesomeness—(applause)—I quite agree with you—where it helps without undue interference—(laughter)—but with reasonable control, just to protect the various sections. That is what happens in a case of that kind. I am going to tell you by and by the limits within which the State can help and the conditions upon which the State can help. I am going to give you both, and it will be for you to judge of that. All I want to say about that part of the argument is that you cannot take any more chances of that kind for this country again; you cannot do it; we came too near disaster. We got through; but it undoubtedly crippled us. We could have put more into our shipping; we could have put more into our other efforts. It crippled the effort of our Allies. We could not spare shipping for them. We had to bring food here when it might have been grown on the premises. I hope there will be no more wars, but at any rate let us have no more chances. We will have fewer wars, if we take fewer chances. If any enemy, and I am sure we have none at the present moment in any part of the world; I feel confident about it; but should we at any time in the future have an enemy, some enemy who envies the might and greatness of this country, some enemy who feels greedy of what it possesses—supposing one day an enemy of that kind arose, we must not put in its way the temptation that it can starve us in the future. That is one of the great concerns of the State. I will give you another. The adverse balance against us in trade is a distressing one at the present moment, and unless you can redress it this country suffers. It is suffering now. It cannot go on buying unless it has got the means to pay. The result of this adverse balance now is that in the Exchange the sovereign is depreciated. There was the British sovereign, the best coin in the world. I do not like to own up, but it is no longer so. It does not fetch the same value as it did in the old days. It has gone down. It is not merely the credit of Britain that is hurt; her pride is hurt. It is the

business of everybody to restore its prestige. I want to see it so restored that the King's head on the sovereign can be lifted up in every Exchange in the world. You can do that—(A voice: "Don't shorten the hours!") I am not going to shirk that; I am coming to it in a minute. There is only one way in which you can put that right. Every industry has got to increase its production, and as agriculture is the most important of all industries agriculture must have the greatest share in the increase. And if I might be allowed to say so, there is more room for increase. You have got the market here at your own doors. It is computed by men who understand this business much better than I do that you can raise in this country food commodities of £150,000,000 worth, which is now brought from abroad. Just think what that means. If you could take away £150,000,000 from what we have got to pay across the water, the sovereign would look up. There would be a new shine on its face. I want you to help the sovereign out of its troubles. If you increase the agricultural production of this country, and I am appealing to every section, not to one, you will be rendering as great a service to the general trade of the country as any service which it is within the scope of any trade or industry to render at the present moment. It is not a question merely of increasing exports; it is a question also of diminishing imports which are capable of being produced in this country without increasing the cost of living, and I think you could do that. I am bound to tell you how much you did during the War. There was a special effort made in 1917. Production had gone back by some hundreds of thousands of acres by the end of 1916. A special effort was made by the agricultural community, on an earnest appeal from the Government, to improve matters. You increased the production of the United Kingdom by 1,750,000 acres. It made an enormous difference. It is a difference not merely in the price of food, but it made a great difference in our shipping. It is not so easy to get the products of 1,750,000 acres and get shipping for it, and get it from Canada and the United States of America. We could get no ships to go as far as Australia. We had to pick our food in the nearest ports we could get it because we wanted our ships for war material, and for men. We were fighting for our lives. And let me here, on behalf of the Government, thank the agricultural community—the landlords, farmers, agricultural labourers, everybody—for helping us to increase the product of the land at a critical moment. Now that the Land Army of the women has been demobilised, I must take this opportunity

of thanking them for the help they gave at a time when so many of our men were drawn away to fight across the seas for their native land. When there was a great shortage of labour they worked with a will ; they worked heartily, and I have no doubt that after a very short experience they worked very skilfully, too. That is what I hear from every quarter.

Before the War the quantity of grain imported into this country was three-fifths of the whole consumed ; two-fifths were produced here. After the War three-fifths were produced here—I am taking the figures of the values—and two-fifths were imported. That is a great change, and it is a change for the better, and it will help in the Exchange. That was the result of the Corn Production Act, which gave a certain measure of security to the farmer that he would not be let down. There were two objections to it. If you will allow me, I have got to deal not merely with the objections of the agricultural community, but as this is a programme which will be criticised by others in other industries, I have got to answer one or two objections which come from outside. There are two objections made to the Corn Production Act. They were made at the time when it was introduced. The first is that the State would lose money by its guarantee, and that you would be paying huge sums of public money out of the pockets of the general taxpayer into the pockets of the landlord, the farmer, and the agricultural labourer. At the time we ventured to say that the prediction would be falsified ; and as a matter of fact it is not true. It has been working now for some time, and not a single penny has passed from the pocket of the general taxpayer to that of the agricultural interest at all. But the guarantee gave the farmer the feeling that he could break up his land without having to return to 1879 and the dark “ eighties.” The second objection made was that it would put up the price of the loaf. So far from that being the case, it kept the price of the loaf from going up, because if this produce had not been raised in this country you would have had to buy more abroad. I want to get this right into the mind of everyone outside who criticises this, that all money which you have got to pay abroad now depreciates the value of the sovereign and therefore increases the price of what you buy across the seas. You are not getting 20s. worth for your sovereign in America. I forget what it is there at this moment. I understand it is 17s. We will take it at 17s. You are only getting 17s. worth for your sovereign, and, therefore, if you

raise the commodity here you are saving 3s. in your sovereign. So far, therefore, from the price of the loaf going up, it has kept the price of the loaf from going up much higher ; that is the answer to those gentlemen who have been criticising that. Therefore the Corn Production Act has increased production ; it enables the farmer to pay higher wages and reduce hours. Well, the hours have been reduced surely, have they not ? That is what I mean. I know what you have got in your minds. I am coming to that. I am referring to what has actually happened. The hours have been as a matter of fact reduced. Very well. The next thing is, you helped the British sovereign ; you stimulated to an exceptional degree the employment of labour-saving machinery. That is important. That has been done without the loss of a single penny to the State. Of how many Acts of Parliament can you say that ? As a matter of fact, there has not been a more successful statutory experiment. Now what is the position we have reached, having restored the productiveness of agriculture part of the way—only part of the way ? Since 1870, 4,600,000 acres of arable land have gone out of cultivation. We have restored 1,750,000. It has gone back a little, I hear, recently. But we have got a long way to travel to get back to 1870, and we want to get further. The question is, are we going back to the dismal pre-war conditions, or are we merely going to maintain the progress which has been made ? Are we not going further ? There can be but one answer from every man who loves his country. We must go forward. How is it to be done ? You must have a settled policy with regard to agriculture. I am glad you are with me in that suggestion. The first condition is security to the cultivator ; security in the first place against ruin through the violent fluctuations of foreign agriculture. I just glanced at the dark 'eighties. The farmers tasted ruin in those days, and many farms became derelict—thousands. I think I could number them by more than that. I have just a memory of it. No mere appeal to argument and to probabilities, no mere weighing up of the prospects of Canada and the Argentine and the United States of America, or the possibility of Russia becoming restored within the next five or ten years as a great grain-producing country, will restore the nerve of the farmer to the point of inducing him to break up his land unless there is some security behind him. What he naturally says is this : " If the State comes in with its guarantee it takes a risk, but it is a slight risk. It may lose money. That is a serious thing

for a heavily burdened community, but it is not disaster. If by any mischance things go wrong with me, what happens? It is ruin. My livelihood goes; my means of livelihood go." That is what happened in 1879, and he says: "You are asking me to take an unfair risk; therefore you ought to come in. If you are confident that the prospects abroad are such that the price will never come back to anything like what it was before the War, you ought to say so, and you ought to say so in an Act of Parliament. You ought to say so in the form of some guarantee to me, so that I feel, at any rate, that I will not be dropped into the chasm, as I was in 1879." I do not think prices are coming anywhere near pre-war conditions abroad. I do not see how they can. The cost of everything has gone up, you must remember, abroad, just as much as it has here. The freights for the carriage of all goods and commodities, including farm produce, have gone up—railway freights, shipping freights. They will continue up, although I do not say at the present figure. Wages have gone up abroad. It is not merely here; I want you to get that into your minds. There are great conflicts at the present moment in the United States of America, and there are still greater conflicts in the Argentine, in reference to wages. The wages were low in the Argentine, so that all the elements that make prices indicate clearly that you are not going to get from abroad the cheap grain which we had before the War. The farmer says: "If you are satisfied of that, what harm is there if you give the guarantee?" I agree, and for that reason I think it is essential that a guarantee should be given, at any rate for wheat and oats. The amount and the length of time are the subject of examination by a Commission. I do not mind saying that I had hoped they would have reported before this, but I have no doubt that there are very great difficulties. There are difficulties in the way of doing anything always. The only thing that is not difficult is to do nothing. I have no doubt there will be objections here and objections there which have got to be met, and, therefore, we cannot hope, I am afraid, to get their report in time. But there is no doubt that the guarantee will have to be given. It must have reference to the increased cost of production; it must have reference also to the fact that when a farmer breaks up his land he has got to look forward for a certain period—it is not for me to indicate the period, because I should be usurping the functions of the Royal Commission. It is quite clear, however, that it is not a matter of looking forward to next

year or the second year ; he has got to look forward—a friend here gives me the number of years, but it is not for me to say that that number is correct or incorrect. It is quite clear, however, that a guarantee, to be of any use at all, must cover a sufficient number of years to make the farmer feel that it is worth his while to cultivate the land. So much have I got to say upon that subject.

But that is not the only security the cultivator needs. Confidence is the best fertiliser of the soil, and there are other elements which are disturbing the cultivator at the present moment. Land in increasing quantities is passing into the market. Before the War it had run up to 250,000 acres. I am sorry to say that this year it will be over 1,000,000 acres that will change hands. That is a disturbing factor, and it is an increasingly disturbing factor. If one felt that it was purely temporary, you might let it be. I wish I were convinced it is ; I do not think it can be. You have only got to look at the facts. In consequence of the War, taxation has gone up enormously, and whatever economies you effect—however rigid they may be—there are permanent charges as the result of the War that remain. There is the enormous debt which has been incurred, which you cannot pay off for some time ; there is the fact that you have got pensions for men who suffered in the War of over £100,000,000 ; there is also the fact that all the charges for the State as well as for the individual have increased at least twofold. You pay your soldiers more ; you pay your sailors more, and the result will be that whatever happens, taxation is bound to be very heavy. Then there is the cost of living, which is doubled, and that presses heavily upon the land-owning classes. And let me say this, as one who has said as severe things about landowners as anybody within the four seas : they, at any rate, have not been a profiteering class. Rents are substantially the same, in spite of the increased cost of living. They made a response to every appeal we made to them with a patriotism which was an inspiration and an example, and I am glad, as one who was an old opponent but who had some responsibility in the conduct of the War, to pay my tribute at any rate to the part which they took in the fight for their native land. Their burdens have enormously increased, and therefore it is probable that in a very considerable number of cases they will find it impossible to maintain their position under the altered conditions without parting with a great deal of land. I am therefore afraid that it is not merely a temporary and a passing phenomenon. Very well ; in that

case we must take note of it. There are many farmers who have been on estates, father and son, for generations, and they feel the same sense of security, or probably a greater sense of security than any Act of Parliament could give them. But when you go to the auction mart, you do not know who is buying; you do not know whom he is buying for, and therefore there is a disturbing element which you are bound to take note of, especially when you are asking the farmer to embark upon a new policy of cultivation which will not reward him for years. He says to himself: "What will the year bring forth? There is my neighbour there, his land has been sold over his head. I cannot tell that my turn will not come." As the interest of the State is paramount, and as the interest of the State is increased production, we must consider that first and foremost.

Now there are five cases where in practice a farmer is liable to notice to quit. Of course, as a matter of law, a farmer can receive notice to quit without any reason assigned; but I am now simply talking about the conditions under which in practice he receives notice to quit. Capricious eviction is such a small element as to be completely negligible. There are five conditions where a farmer may receive notice to quit. The first is where land is required for public purposes; the second is where the land is so badly cultivated that the landowner feels it is not merely in the interests of the land, but in the interests of the community, that he ought not to continue in the tenancy, and that is absolutely right; the third is where the landlord desires to regain possession of the land in order to cultivate it himself or to place a member of his family upon it. That is generally applicable to the case of the small landowner. That does happen. Now those are three cases which I put in a separate category. In those cases where a tenant leaves he receives compensation under existing Acts, and if those Acts are in any respect inadequate, the Government are prepared to consider the respects in which they might be strengthened. But there are two cases where the farmer undoubtedly stands in need of special protection, and it is essential that he should receive that protection if he is to respond to the appeal which is made for increased production. The first is where the farm is sold over his head to another landowner under the circumstances which I have just detailed, and where a new man may either want it himself, or he may want to sell it and make money out of it—I am sorry to say I have known cases of that—and where the poor farmer cannot

raise a sufficient sum of money to meet the sometimes rather extravagant price which is asked on a re-sale. I can give cases of that kind. In those cases the farmer needs protection, and must get it.

The second case is where notice to quit is given in order to raise the rent. I do not say that is not a justifiable operation in a given case, not in the least. It may be a perfectly justifiable operation in a given case. Under the Corn Production Act the landlord is forbidden to raise the rent during the period of the guarantee except with the consent of the Board of Agriculture. What is proposed is that when notice of that kind is given the tenancy shall not be affected, but the new rent should be fixed either by agreement between the parties, or, failing agreement, by an arbitrator appointed in the usual way. That, I need hardly tell you, is not a Land Court ; it is simply an operation which I have seen in a good many cases where the parties, if they cannot agree as to the amount of the rent, refer it to arbitration.

Now those are the two securities ; first of all, there is the security of the State that the farmer will not be ruined by expected developments in the agricultural world abroad ; and the second is a guarantee that he can put the whole of his capital, his brains, and his energies into the cultivation of the land without feeling that all his efforts may simply result in his labours being transferred into the possession of others, or his rent being raised upon his own improvements. That is the guarantee of the landlord. There is, first of all, the guarantee of the State ; there is, secondly, the guarantee given by the landlord.

Now I come to a third guarantee, and that is the guarantee of the farmer himself. It is a guarantee that he will do his best to increase to the maximum production. That is the next guarantee I want. Under the Corn Production Act there are powers to deal with a slack farmer. There must be some ; there are not many, I know, but in every profession—even in the profession of the law—there are slackers. The power of the Corn Production Act is there to deal with them, because they discredit their class ; they reduce the wealth of the community ; they diminish its security ; they depress the food of the country, and, therefore, there is no room for them in a small country like ours. There is plenty of land for them in the Argentine, in Canada—right up to the North Pole—and in the United States of America, but in a

small country like ours there is no room for the slacker ; it is too small.

Now I come to the agricultural labourer—guarantees given to him and guarantees asked of him. What about the guarantee to him ? Under the Corn Production Act there is the guarantee that he shall get a minimum wage. I make no apology for that—none. There are many things which I have said before the War which I would probably like to have censored ; but this I make no apology for. The wages paid in certain areas to agricultural labourers were a scandal. They were a folly. There is no worse business—*business*—than underpaying a man for his work, and the part I took in calling attention to that I make no apology of any sort or kind for. I am glad, at any rate, there is a guarantee of a minimum wage. The hours of labour have, by arrangement, been in many respects very appreciably improved—(“ shortened ”)—well, shortened ; it depends upon your point of view whether that is an improvement. Now I am going to say a word to the agricultural labourer. I certainly cannot be charged with not being a friend of his. I fought for him before his present friends were ever heard of ; before many of them had ever seen an agricultural animal, except in the form of beef-steaks. But I want to say this—I want to appeal to him to help in the national programme of cultivation to the utmost of his power to produce food. I also want to say that I am all for his getting a good minimum wage. I am opposed to any workman being called upon to work beyond his strength ; it is not that it is no good to him ; it is no good to anybody else. I say, however, in all solemnity, the agricultural labourer will make a mistake if he takes advantage of the present labour shortage to drive too hard a bargain. I say so, and I ask his guides and himself to look up the historical precedents. There was a time in the history of England—I think it was after the Black Plague—when there was a serious shortage of labour on the land. The result was, impossible conditions were exacted. It made cultivation quite impracticable ; it drove the cultivator, because he could not secure labour under profitable conditions, into methods of cultivation which needed the least quantity of labour. What was the result ? England depopulated ; England desolated ; and the labourer was the man who suffered most from that policy, I fear. I want in all solemnity, as a real friend of the labourer and as one who advocated his cause before the War—and I hope his representatives are here, because they were invited—to ask him to consider carefully the conditions, and not to insist upon conditions

which will make national production impossible in this country. We must have the co-operation of all classes to make this a success—the co-operation of the farmer, landowner, labourer, and State. “Co-operation” is the word for Capital and Labour in all industries at the present moment, and without it we shall fail.

There are two or three other things which I must refer to, otherwise it will be said : “ He never mentioned so and so, and he never mentioned so and so,” and there are people who live on that sort of business. There is the question of credit. Increased cultivation means increased expenditure, and you cannot bring production up to the level of Denmark, France and Germany without increased capital expenditure on the land. That is applicable to both the landlord and the farmer. So far as the landlord is concerned, as I pointed out, in that respect he has fallen on bad times. I have given the reasons. I am hopeful that the fact that the industry has been placed upon a more firm foundation, and that security is introduced into it which was not present before, will make it easier for the cultivator to negotiate the necessary credit facilities for the development of his programme. I am looking to the great banking concerns of the land to be helpful in this respect. It has been possible in other countries to organise credit facilities, and why should it be impossible in England ? I hope that they may be obtained by ordinary business methods ; but I wish you clearly to realise that the Government are determined to leave nothing undone to put this industry upon a satisfactory basis, and that they do regard credit facilities as one of the necessities if this object is to be secured—both long-term credit facilities to enable landlords to provide and cultivators to secure suitable and sufficient buildings to accommodate live and dead stock, and short-term credit facilities for farmers and smallholders to purchase implements, seeds, fertilisers, and other prime necessities for their industry. Transport I have already said something about in the last few days. I regard the development of transport facilities as essential to a revival in agricultural prosperity. Too often, transport arrangements in the past—railway and otherwise—have had a bias against agriculture. If there is to be a bias at all, it ought to be a bias in favour of agriculture. There should be increased facilities—where necessary, new railways, motor services, lorry services—to open up agricultural districts and to bring their produce to the market, and to get the necessary material for the carrying on of their business. I hope that it may be possible to so

arrange the rates, at any rate, as not to handicap the farmer in a business which is so essential, which is just as essential to the towns as it is to the rural areas.

May I just say one word here about the importance of co-operation? The difficulty in the past, according to the railway managers, has been that it has been so difficult to get the farmers to co-operate. Whereas you can give transport facilities if the whole of the people in a given area bring their goods together, it is almost impossible to do it if you only deal with individual farmers. Therefore, it is important to deal with the bulking and the packing of the goods. The co-operative movement generally deserves in that respect all the help and welcome which the farmers of the community can possibly provide. I should have liked to have said something about scientific State aid, because it is very vital to the life of agriculture, and increased technical instruction. Much can be done to increase the yield and profit per acre by supervision of seeds and manures, by ensuring that those of high quality only shall be sold; by the extension of Government demonstration farms; and by the improvement of live stock by State-aided distribution of good sires, and the promotion through County Committees of intensive cultivation—all these things are of first importance—and the wider use of labour-saving appliances. But, last of all, I should like to see steps—strong steps, bold steps—taken to lure the population back to the land. The land, as I have pointed out, has been the nursery from which the industries of the country have drawn a virile population, which has invigorated them and given life to them. The nursery is pretty empty now, and there is no surplus population to spare. It is a weakness to the State; it is an impoverishment of the land, and steps ought to be taken, not merely to keep the population there, but to bring back labour to the soil. There is much to be done for the regeneration of rural life in England. Men have been drawn to foreign lands by placards on the wall with attractive pictures of what is awaiting them when they cross the flood. If we only keep the population on the land and bring others back there England will be a better placard than any you can paste on her walls. We want more cottages, with land attached. I was appalled when I went to my native village a short time ago. I just rambled about the woods and the fields there, and I was appalled at the number of cottages that I remembered—I am getting on in years it is true; but still it is not so long ago in the life of a country—that are moss-grown and filled with brambles and

briars instead of smiling children—everywhere. You want cottages with land attached. You want rural industries regenerated. In the old days we had little industries even in that village. They are gone. They provided employment for the women and for the children and the men when there was nothing special calling for their services on the farms. They helped to supply labour, to keep the people from going away. It was a cheer through the place to have the whirl of those wheels. When they stopped, life became more depressing in the villages, and the men—especially the young men—fled away. Well, when we get electrical power developed in the country—do you know that in some continental countries they milk the cows with electricity—(A voice: “And in England”)—Yes, quite true, in the north of England, turning the lightning on to milk the cows. They will help to revive the rural life. You must make the villages attractive. It is all very well to say that is not business; it is business. The dullness of the villages is appalling. I was brought up in one. I should not like to begin again under those conditions. The oppressive dullness was appalling. It chased men away. Let us chase the dullness away and regenerate the old country life of England and make the country more attractive, as it is much healthier for brain and muscle and heart than the towns. It is the thing which, if a man has got it into his composition, enables him to bear the worst wear and tear of life—generations of what the country has poured into his veins—he has got the son of England, of Scotland and of Wales with its eternal endurance warming every fibre of his nature, and he goes through all the troubles of life facing them. Get the people back to the land, to the resurrection of that life. Then you will find the country not a picturesque desolation, but England will be really a garden ringing with cheerful and contented life.

Colonel FITZROY: It is with the greatest possible pleasure that I rise to move a vote of thanks to the Prime Minister for his speech this afternoon. At the beginning of his speech he referred to the fact that the meeting which has been held to-day was in response to the demand from a deputation which attended him in July from the House of Commons. It is as Chairman of the Agricultural Committee of the House of Commons that I rise to-day to thank him for this meeting and for the speech which he has made. As representing that Committee in the House of Commons I

think to a certain extent I can speak for agriculture generally in this country, for that Committee is composed of members of all shades of political opinion who have been duly elected to represent agriculture in the Parliament of this country. As such, I can say the speech to which we have listened this afternoon will give the liveliest satisfaction to the agricultural community throughout the length and breadth of the land. We know definitely that the Prime Minister of England at this present time is the true friend of agriculture. What we have suffered from in the past is chiefly the ignorance of the community—not alone from their ignorance of the difficulties of agriculturists, but from their ignorance of the importance of the agricultural interests to every member of the community, not only in the supply of food to themselves, but in what the Prime Minister touched on at the end of his speech, the extreme importance of keeping the people on the land. It is with those views, and feeling so satisfied and gratified as I do with his speech this afternoon, that I move a hearty vote of thanks to him.

Mr. OVERMAN : I rise to second that hearty vote of thanks to the Prime Minister for coming here to-day. I am sure I am voicing the views and the hopes of all my brother farmers behind in accepting from him the settled policy of the country or of the State. We wanted that badly to restore our confidence. I can assure him there will be nothing wanting, I am certain, on the part of the farmers of this country to increase the production of the land. They have proved by their action during the War that the nation is very near to their hearts. They have done their duty in the past and they will do it again in the future. The farmers have been suffering lately from want of confidence, and I am certain that the words that have fallen from the Prime Minister, giving us assurances—and very helpful assurances I call them—for the future, will tend to bring the farmers of this country to help and forward the wishes of the Prime Minister's and the rest of the Government's hearts.

The CHAIRMAN : A resolution of thanks to the Prime Minister has been moved by Colonel Fitzroy and seconded by Mr. Overman. I do not propose to add anything to it except to ask you to pass it with acclamation.

(On being put to the meeting the vote of thanks was carried unanimously.)

THE PRIME MINISTER: Thank you for that very cordial vote of thanks and for the kind way in which it has been proposed by Colonel Fitzroy and seconded by Mr. Overman. I also thank you for the very cordial way in which you have received it. I hope now we shall be able to go on working together to restore agriculture, not merely to its old position, but to make it something that the whole world will come and look at and study. I know that you are quite capable in this country of being able to do it. I know what can be done in a very short time, and if you put your backs into it I am sure you will succeed.

SPEECH

BY THE

RT. HON. LORD LEE OF FAREHAM

*(President of the Board of Agriculture) at the Shire Hall,
Gloucester, on 10th November, 1919.*

LORD LEE said: I regard it as a very great privilege that I should be permitted to make my first speech as President of the Board of Agriculture to a Gloucestershire audience. I am under particular obligations to Gloucestershire farmers for the splendid help which they extended to me and to the cause, when I was Director-General of Food Production. I am not in the habit of handing about bouquets; but I have particular recollections of the way in which Gloucestershire farmers played the game in that fight against the most deadly peril which has ever menaced this country—the German submarine. I know that between them they added no less than 33,000 acres of breadstuffs—which includes corn and potatoes—to the county area; an increase of 50 per cent. over the pre-war figure. That was a great achievement; and I know how much we owe to them, to the County Committee, and particularly to its Chairman, Mr. Dent Brocklehurst. I am glad of this opportunity to express my thanks to them.

I cannot help remembering that my predecessor, Lord Ernle, spoke here only a short time ago; and when I think of his great experience and knowledge of everything agricultural, and of the weight of his prestige as one of the foremost agricultural experts in this country, if not in the world, I feel somewhat diffident in addressing you. I am also conscious of the fact that another of our great agricultural experts and authorities, my friend Lord Eledisloe, is at my elbow, and I am afraid I feel very much of an amateur in his presence. But, at any rate, I do not pretend to be an expert, and that is something gained, because it means I have got to rely on advice, and I am seeking that advice, of all the most practical agriculturists that I can find. Of course I do not say that all my advisers agree; and my duty perhaps is to exercise a certain judgment between the different kinds of advice that are given me, and to try and steer a straight course. I will at any rate say this, that I have got a perfectly definite mission to carry out; and that is, in the interests of National safety, to do what the Board of Agriculture can do to reduce

the dependence of this country upon supplies of essential foods from overseas. Whilst of course that must be done with due regard to the permanent interests of the Agricultural Industry, it can only be done by developing home production to the maximum of which the land of this country is capable; and this policy is essential, not in the interests merely of this or that section of the Agricultural Industry, but in the interests of the whole nation, and more particularly of the urban population.

That is a very important point to keep always before us; that the very existence of our dwellers in the towns may depend upon the prosperity of the Agricultural Industry; and I most earnestly trust that the old suspicion, amounting sometimes even to hostility, that existed between urban and rural interests, may be finally killed by the lessons of the great War through which we have just passed. That distrust and suspicion—that wedge between the urban and the rural population—was one of the greatest dangers with which the community was confronted; and it has got to stop. It is, I consider, one of the most important tasks which a Minister of Agriculture and the Government can possibly assume, to try to bring about a better understanding between town and country.

In this connection farmers can do a great deal to help. I should like them to show a little more sympathy sometimes with the newcomer on the land, with the small holder, particularly the ex-Service man who is a small holder, and also with the allotment holder, not merely because they, too, are producing food in a very important sense, but because, if I put it only on the most selfish business ground for the farmer, if they want their interests properly looked after in Parliament, they will have to have a much larger voting strength in the country than they have at present. There can never be a big voting strength for farmers alone. The only way in which you can increase the voting strength of the food producers is by bringing in the small holders and the allotment holders. All together they will form a mighty army, if united; and that is the only way in which the farmer will be able to get his case properly listened to in Parliament, by getting all the food producers working in the same direction.

When I said just now that the farmers are sometimes unsympathetic to the smallholders in their midst, I was speaking of the country generally. I do not say that is necessarily the case in Gloucester. But I do know this, that the Gloucester

Small Holdings Committee is considerably in advance of a good many of the committees in other counties. They are making good progress, at any rate with their land acquisition, and I hope they will soon make equally good progress with the equipment of the land which has been acquired. I think it might interest you if I just quoted one figure. There has been a general charge of extravagance in purchasing this land for small holdings throughout the country. I have had the figure worked out, and I find that, up to date, whereas the average price per acre of land taken for small holdings before the War was £33, to-day the average is not more than £41 10s. 0d. Considering the nature of the land that has to be acquired, and the tremendous rise in the price of everything else, I think that shows that land acquisition has not been carried out in an extravagant spirit by the small-holdings committees generally.

However, I come back to the main point, which is that Home Production must be increased, and there is only one way in which it can be largely increased, and that is by an extension of the arable area. I know there are some farmers who will not altogether like that; but it is absolutely essential, not merely for the production of more cereals but for the production of more meat and more milk. It is an established fact, that cannot be gainsaid, that you can produce more meat, more milk, more cereals and more potatoes on arable land than you can under any other system of farming; whereas, under an extended system of grass farming, you will produce less of all those vital commodities. There really is no such thing as the "Corn versus Horn" controversy. It is a pure bogey. It is a thing which is sometimes put forward by men who do not desire to embark upon arable farming. But everybody who has studied the matter knows, that on arable land you can raise at least twice as much meat and milk as you can upon grass; and we have the experience not only of people who have done it in this country, but the far more extensive experience of countries like Denmark. At any rate, do not make any mistake about what the Government policy is. It is to have more cereals, more breadstuffs, and also more meat and more milk, and the policy which has now been announced by the Prime Minister would bring about an increase of all those vital commodities. The Government is determined, in the National interest, not merely to maintain but to extend the area of arable in this country, and we shall stop at nothing which will assist to compass that end. I do not mean to say

that in the course of the Food Production Campaign, here and there some land may not have been ploughed up that would have been better left down. That was inevitable in a hurried campaign of that kind. Mistakes were made, and in some of those cases no doubt it would be better that that particular land should be laid down again to grass. All I say with regard to that is that when it is laid down, with the approval of a county committee, it should be properly laid down, and not allowed to tumble down. It should be properly laid down, because there is nothing more important, after the extension of arable, than that the grass lands of this country should be improved, as they can be improved, and carry a far greater head of stock than they do at the present time.

Now we come to the question of how is this to be done ; and there is no doubt that, if there is to be an extension of arable farming, the first essential is that there must be the establishment of confidence in the mind of the farmer. After all, farmers, particularly the older ones, have long memories. They remember the 'eighties and the 'nineties, and the disaster that came upon many of the best farmers in the country through the disastrous slump in prices. Their feeling of anxiety is well founded. I am not blaming them for it in any degree ; any more than we blame the burnt child who dreads the fire. It is quite clear, if there is going to be an advance in food production in this country, the first essential is a sense of security and a confidence that if the farmer is going to be asked to adapt his farming, not merely to the interests of his own pocket, but to the far greater interest of the Nation—and that is what we are asking him to do—he will have security against the possibility of a recurrence of what happened in the 'eighties and the 'nineties. That is to say, if he breaks up his land, and in response to the National call goes in on a much larger scale for growing cereals, he must be protected against the risk of bankruptcy and financial disaster through a serious slump in prices. We do not say that he should be guaranteed a profit. He must take his chance in the market for that ; but we do say that he should be guaranteed against disastrous losses for which he is in no sense responsible. Therefore, the system of guaranteed minimum prices for wheat and oats must be continued ; and continued on a scale which will take into consideration the great increase in the cost of production which has come about since the Corn Production Act was passed.

My own personal view as regards the period is that the guarantee should be permanent ; at any rate, that it must last so long as the policy continues of safeguarding this country against the submarine menace—and goodness knows what that may be in any future war. If by any means war were for ever abolished, and the League of Nations justified all the dreams of those who are enthusiastic about it, then at any rate the farmer should be given at least four years' notice before the system of guarantees is brought to an end.

With regard to the actual figures, as you are aware, there is a Royal Commission sitting at the present time considering this very question ; and it would not be reasonable or courteous to them that we should lay down the figures in advance of their Report. But I will say this : that the Government policy is fixed, and that failing a Report from the Commission on this point—I do not think we have any reason to anticipate anything of the kind—the Government must and will act on its own responsibility.

That is the first security the farmer needs if he is to assist this National policy. The second security that he needs is, that he must be protected against capricious eviction from his holding if he is farming well. If he is not farming well, and if he is not doing his best by the land, then he is entitled to no protection whatsoever ; and he will get neither sympathy nor protection from the Board of Agriculture. And I may add, he will not get it from his own class either, because good farmers are beginning to realise that the greatest handicap to them is the slacker who brings discredit on the whole industry. But the good tenant must be protected against capricious eviction or unreasonable disturbance. Here I know I enter upon a highly controversial question ; and my object is, if possible, to try to find some kind of agreed solution. The evil cannot be disputed. England is rapidly changing hands. At the present time there are unprecedented sales of farm holdings, in many cases over the heads of the sitting tenant who may have been there for generations. As a result there is a general sense of insecurity creeping into the minds of farmers or, at any rate, a feeling which is fatal to any enterprise and extension of our arable area. Therefore, that movement of sales is becoming injurious to the National interest, and something has got to be done ; because if the old beneficent relationship between the good landlord and his good tenant—which, in my judgment, was perhaps the finest form of partnership

and security which could be conceived, but which I am afraid, owing to taxation, death duties, and all the financial troubles of the time, is rapidly passing away—if that ideal security disappears, something has got to take its place. New conditions demand new remedies ; and I am quite sure of this, that good tenants have no desire whatsoever to be benefited in any way which is unfair to the good landlord. They do not wish to see a vicious system of dual ownership set up, nor do they ask for fixity of tenure at unduly low rents. That is not what they are after. What I believe their main requirement, so far as I can ascertain, is that they want security for their own capital—for what they have put into their holding, whether it be in the form of their money or their brains ; and, if it should become necessary for them to be displaced, they want to be assured that they will receive full and fair compensation for everything that they have put in. That, I think, is a reform which must be brought about by an amendment of the existing law. The existing law is not satisfactory upon that point, and it will have to be strengthened considerably.

There must also be an obligation on the other side, that if a bad tenant deteriorates a holding and runs it out, he should then be called upon to give reasonable compensation to his landlord. I know that there I have the best farming opinion with me. The National Farmers' Union, is advocating a reform of that description, which is just as fair to the good landlord as the other reform I have mentioned is fair and reasonable to the good tenant.

Then with regard to rents. There are some rents no doubt in some parts of England that are too high ; but I venture to say there are many more rents, particularly in the south of England, which are too low—so low that it is impossible for the landowner to get such a return upon his capital as will enable him to live. In those cases I say it is necessary that there should be some recognised form of arbitration open to tenant and landlord alike, to which either of them can appeal upon a matter of rent, and which will have the power of fixing a rent up or down as the justice of the particular case may require. That, I think, would be only fair to both sides, and I hope to see such a system of arbitration effected by legislation in the near future.

I cannot help feeling that, with regard to this very controversial question, there is so much in agreement among the reasonable men on both sides, that I am extremely sanguine of being able to bring about a friendly solution. But, at any rate,

we have got to have a solution. Confidence and a sense of security have to be created if the National policy is to proceed.

Let me repeat that these securities, both with regard to guaranteed minimum prices and with regard to tenure, must be coupled with a condition that the tenant makes the best use of his land. I hope in this connection that we are going to have, in permanency, a proper measure of supervision and control by our reconstituted County Agricultural Committees, who will see that the land within their jurisdiction is used to the best advantage. There is no room in the agricultural future for the slacker or for the bad tenant, or I may add for the bad landlord either.

There is another question upon which it is essential that the farmer should have a feeling of confidence, and that is with regard to his labour. I am now touching upon another highly controversial question; but, ladies and gentlemen, I am not going to shirk these questions, because I think the time has come when we have to speak out and say what we think. I hope in this audience which I am now addressing, there are representatives of labour as well as of employers. The labour question is the most difficult of all with which agriculture is confronted, and yet it is the key of the whole situation. I want to make it quite clear that I have the most real, I might almost say the most intense, sympathy for the position of the agricultural labourer as it has been up to very recent times. I think, speaking generally, the conditions under which the agricultural labourer has had to live, and the remuneration which he has received in the last few generations, has been a scandal and an injury to the best interests of agriculture. Now the sins of the fathers are being visited upon the children, and we undoubtedly have an unhealthy feeling of distrust between the employer and the employed which cannot be permitted to continue if agriculture is to flourish, and which can do no good to either of them. It must be removed at all costs. And here I say to the farmers, it is no good trying to fight against the increase of the agricultural labourer's wage to a point which will at any rate approximate to the wage which is paid to other men in rural industries working alongside him. It is no good saying that the agricultural labourer must be a sort of class apart and paid less than anyone else. He will not stand it; and there is no reason why he should stand it. His unions will grow and agitate so long as there is any attempt to make him stand it; and on the wages question farming will have to be adjusted, and can

be adjusted, I am convinced, so as to enable it to pay as good a wage as is paid to men who, as I say, are working alongside the agricultural labourer in the same rural conditions.

I will also say this, that just as there is a vicious circle of prices leading upwards, so there is a vicious circle of prices leading downwards. Cheap labour in the past has been the result of low and unremunerative prices, and if you are going to have, as I hope you will have in the future, remunerative prices for your produce, it is necessary that the labourer should have his share in that upward movement. The conditions under which he lives need also to be bettered. The housing of the labourer in the past has too often been a disgrace to this country. It has got to be bettered, and we are hoping to assist in that betterment by the great housing schemes of the Ministry of Health, and by the cottage holdings which we are hoping to institute on a large scale throughout the country under our Land Settlement Scheme. After all, the possession of a decent cottage and a little bit of land on which the man can raise some food in his spare time for his own family is no more than any human being is entitled to. We must create, if we can a little more human sympathy and understanding between employer and employed in these matters. Unless you do that, you will not get the co-operation between them, without which Agriculture cannot flourish.

Now, having said that and I say it, believe me, with the most genuine sympathy with the conditions in which the labourer has been brought up--I say there is something to be done on his side also; and that he must not show himself unreasonable with regard to the question of his hours of labour. There could not be any greater folly than to try and make the conditions of agricultural labour coincide with the conditions in urban industries. It is physically impossible. After all we have to consider the weather in farming. Factory hands work indoors. It matters not whether it is summer or winter. Their work-place is well lit, and they can work exactly the same hours under the same conditions whether it be winter or summer. Agriculture is something totally and entirely apart, and every agricultural labourer knows in his heart that it is entirely different. All I can say is this, that if he succeeds in forcing Parliament to make agricultural conditions and hours coincident with urban conditions and hours, there is only one inevitable result, and that is that nearly every farmer in the country will be

driven to lay down his land to grass. He will have to do it for his own existence, and what will be the result? That only one-fifth of the labour will be employed on the land. Eight men out of every ten employed on the land will become superfluous, and the labourer will find that he has merely sawn off the bough on which he has been sitting. That is surely not in his interest; and therefore I do most earnestly hope that he will not agitate, nor let those who are speaking for him agitate, for the inclusion of Agriculture in the Forty-eight Hours Bill. By a recent decision of the Cabinet, Agriculture has been definitely excluded from the Forty-eight Hours Bill. That is the Government's policy, and the only way in which it can be changed is by Parliament taking the matter out of the hands of the Government and passing a Bill in a different sense. I cannot believe that that is going to be done. It would be absolutely fatal to Agriculture. The Government is willing, and I am sure Parliament is willing, to consider any reasonable amelioration of the labourers' conditions which can be effected through the Agricultural Wages Board, which is an institution that has come to stay, however little it is beloved by farmers at the present time. But that is the proper body to consider these conditions and to settle them.

I only wish to add that the Board of Agriculture is as keenly solicitous about the welfare of the agricultural labourer as it is about the welfare of the farmer or the landowner. The Board is not the special guardian of the farmer or the landowner. It has an equal interest in every branch of this great industry. Its aim, and my aim, is to try to bring all these interests together into harmonious co-operation, because I know that in that lies the only possible hope of that increased production upon which our National safety depends.

I am afraid I have detained you a very long time—"No," and "Go on"); but perhaps you will allow me to touch upon one or two other questions, because I do not want it to be said afterwards that I shirked this or that question. It is quite obvious that I cannot touch upon everything; but there are one or two other points on which I should like to say a word.

I have been accused, personally, of being indifferent to the great live-stock industry of this country—that I am mad about the plough and nothing else! That is rather hard upon an amateur farmer whose chief personal interest, as a matter

of fact, is in his live stock. I have got some very good live stock, by the way, and I should not like to adopt any policy which was going to be detrimental to it. But what my personal feeling is does not matter. On the other hand, what the Board of Agriculture is doing in this matter is very important indeed, and I may say we are taking an increased interest in the prosperity of the live-stock industry. We are securing, amongst other things, increased grants for the purchase of what are known as Premium Bulls, particularly those of milk-yielding strains. We are fostering and helping to finance Milk Recording Societies all over the country—one of the most important reforms that can possibly be introduced, because through the operations of the Milk Recording Societies the farmer can find out how to increase his production of milk, sometimes by as much as from 20 to 50 per cent. We are also instituting on similar lines Boar Societies for the improvement of pig breeding, in connection with which we hope to give some special assistance to the small holder. We are also instituting Ram Societies for the improvement of hill sheep. In all those matters we are trying to bring about the provision of better sires for all classes of live stock, and we are not forgetful of the interests of that great National industry, the breeding of pedigree stock. In that matter we are starting a new branch at the Board of Agriculture, which will be specially charged with looking after the interests of exporters of pedigree stock. It will be our business to bring the buyer and the seller into the closest possible touch, and to conduct propaganda in foreign countries pointing out the merits of British breeds. Then we are doing what we can to improve our organisation for dealing with animal diseases, particularly with swine fever and contagious abortion. We are setting up an increased staff of experts, and making additional grants for research to tackle these diseases, and I would like just to say this with regard to the recent outbreaks of foot-and-mouth disease, which have been of a very serious character, that whatever you may have heard, I can assure you on behalf of the Board of Agriculture there has been no relaxation of any kind in our precautions and regulations. There have been no importations of any sort or kind of foreign cattle. There has been no importation, so far as we know, of any hay or other feeding stuffs from countries which are affected, and whilst the outbreaks have been serious, I think I can assure you there is no cause for panic and that the matter is well in hand.

There is another great reform in which we are engaged, in conjunction with the new Ministry of Transport, and that is the provision of increased transport facilities for all classes of food producers. We are trying to arrange for more trucks on the railways and lorry services on the roads, and new lines to open up districts which are at present badly served by railways. All those things of course must take time, but they cannot be successful unless we get the co-operation of the farmer. He has got to assist by co-operating, by grading and packing and delivering his goods in a way which is handy and convenient for the transport service. If he does not do that, he will not get any help from the Transport Ministry, and he will not get any help from the Board of Agriculture. I think even those who hold out longest are beginning to realise the vital importance of co-operation in connection with agricultural prosperity. Co-operation is not a matter of sentiment; it is a matter of hard business. After all you must face this fact, that the mass of the people, the consumers, will not tolerate prices of food in the future which are brought about largely by unnecessary profits to middlemen between the producer and the consumer. Unless all unnecessary profits are eliminated, both with regard to the requisites that the farmer uses and with regard to the prices of his produce, there will be a general unrest amongst the consumers which will be very injurious to Agriculture. In fact, the farmers have really got to decide whether they are going to co-operate amongst themselves, or whether they are going to allow Government control to do it for them. Every kind of unnecessary profit must be cut out. When I am informed, as I was the other day, that Rhodesian maize, which was paying the producer in Rhodesia 16s., was being sold in this country at 80s., one realises how many profits there had been made on the way, many of which must be entirely unnecessary. I am glad to think that there have been very great strides made in the agricultural co-operative movement during the last twelve months, and that one-third of the farmers have already joined the co-operative movement. I want to see the other two-thirds join as rapidly as possible. After all, co-operation cannot succeed without two things: the first is more capital, and the second is a keener sense of loyalty amongst the members of the various societies. There can be no successful business without adequate capital or without the support of those engaged in the business. I need hardly add, co-operation is especially important and necessary for small holders and

allotment holders in connection with the purchase of their seeds, fertilisers, and all their other requisites. I would especially commend to you the operations of the Agricultural Organisation Society. It is doing splendid work, and it only requires a little more assistance from the farmers and the small holders to make it one of the greatest mainstays of your industry.

There are many other subjects on which I would have liked to speak—upon Research and Education especially—but I feel I have already detained you too long and I will only say this in conclusion.

I am very proud of my present responsibilities. I am proud of the fact that the importance of the Board of Agriculture has at last been recognised by its being made a first-class office, and being included in the Cabinet. I do not pretend that I am specially qualified for this position. Certainly I have not sought it; but having accepted it, I intend to devote whatever powers I possess to the carrying through of this great National policy of increasing our safety by making us less dependent upon food supplies from overseas. And may I say this? The peril is not only a peril in war-time; there are perils in peace also, as we see from the present American strike. If we are to be dependent for our food supplies upon even such a friendly country as America, how are we going to live if the whole of their social system—the transport service and ships—are hung up by a railway or a coal strike? We have to be independent of those things if we are to live in safety; and we have also to consider the stability of our National finances. At the present time, if we spend £1 overseas to buy food we only get back 17s. worth; and our money goes into the pockets of the foreigner. If we grow £1 worth of food in this country, we get a pound's value for it, and the money goes into the pockets of our own people.

Now, that is worth considering. At any rate, the Government policy with regard to this matter, which I have sought to explain to you this afternoon, is definite and determined. It is also a complete and a balanced policy. You have got to take all or none of it. It is no use for the farmer, the landowner, or the labourer, to think he can just pick out the plum that suits him and leave the rest. It all hangs together, and is based, believe me, upon no political consideration

whatsoever ; but solely upon what we believe is the highest National interest.

At any rate, I took office with but one idea, and that was to try to administer and to press forward this particular policy. Anything or anybody that helps it I will back up and help by every means in my power. Anything or anybody that hinders it I will fight and oppose by every means in my power. Now that, I think you will agree, is plain speaking. I have not come here to administer soothing syrup to any section of the Agricultural industry. I have come here to say plainly what our policy is, and hope at least that you will not say that I have not been definite. I have tried to lay all my cards on the table, and, having done so, I feel perfectly certain that all sections of the Agricultural industry in Gloucestershire will support me as loyally in the future as they have done in the past.

LORD BLEDISLOE : Mr. Priday, Ladies and Gentlemen. On your behalf, and on behalf of this county, I desire to express our most cordial thanks to Lord Lee for coming here to-day, and for delivering to us the interesting, stimulating, and, above all, courageous speech to which we have just listened. My Lord, we are flattered and pleased that you have selected the County of Gloucester—no mean county in an agricultural sense—for your first public pronouncement as Minister of Agriculture. You have to-day filled the gaps, dotted the i's, and crossed the t's of the remarkable speech of the Prime Minister on agricultural matters, which was delivered in London some three weeks ago—a speech remarkable particularly in the fact that a Prime Minister of this country for the first time within human memory, came before the public and pronounced that he intended to stand or fall by a policy which meant the promotion of agricultural interests above all other industrial interests in this country. I cannot help thinking that that epoch-making speech was largely inspired by the courage and enthusiasm of his newly-appointed Minister of Agriculture.

Lord Lee has been very modest—much too modest in my judgment—in suggesting that he is not greatly experienced in agricultural matters. At the present crisis in our agricultural history, there are in my judgment qualifications of far greater importance than personal knowledge and experience of agricultural processes. The highest qualification of all (Lord Lee possesses it in a paramount degree) is that of courage

and determination which will induce him to see that this promised policy shall be carried out, whatever may be the criticisms which may come from short-sighted or urban interests in the future; courage and determination which will see that the demands of the Board of Agriculture are not made to give place, as they so often have in the past, to the demands of other competing Departments. It is this feature above all others which has been evidenced in the speech to which we have listened this afternoon, and which I think will inspire us all with a hope that this, if I may say so, statesmanlike and great agricultural policy that has now been put forward both by the Prime Minister and by the Agricultural Minister, will in fact be carried out to the advantage not only of our industry but to the enormous advantage and the increased security of the public of this country.

It is all based, as I understand it, upon security of three different kinds: security of tenure—and no one grudges a good farmer that; security of capital, which in my judgment is the most important of all if we are going to maintain our arable area; and security of markets, which have got to be maintained, my lord, even in face of some criticism from the perhaps possibly less far-sighted population of our crowded towns.

With those three elements of security, we have a real promise of maintaining the home production of our food at the high standard which it has reached during the War, and thereby securing the real security of the Nation upon which it ultimately depends.

Lord Lee has referred to a great many matters, and I do not intend at this hour of the afternoon to follow him; but he suggested one particular proposal which I have no doubt will be open to a certain amount of criticism. He says, and I think he justly says, that if prices are to be guaranteed for agricultural produce, if the agricultural labourer is to continue to enjoy a guaranteed minimum wage on a much higher standard than he has known in the past, there must be more security both to the landlord and to the farmer in the matter of rent; and he suggests that some system of arbitration shall be set up to secure that.

Ladies and Gentlemen, I hope he will be successful in evolving some system which will secure fairness between landlord and tenant, but which will not lead to a Land Court, and will not

lead to dual ownership. ("Hear, hear," by Lord Lee.) This attempt to adjudicate between landlord and tenant has led to disastrous results in the sister island of Ireland; and I hope that in working out a scheme involving adjudication upon rents, we shall avoid those unfortunate results which have followed from such attempts in that sister island.

As regards wages, candidly I have no fear, whatever may be the reasonable demands of labour, so long as they do not extend to hours. I have no fear as regards wages if the Government really mean—and I believe they do mean—that in assessing what shall be guaranteed prices for produce, the whole of the cost of production shall be taken into account, which, of course, especially means the cost for the time being of labour itself.

I was very glad to hear Lord Lee ask farmers in this county, as elsewhere, to do what they reasonably can to support both small holdings, particularly ex-soldiers' small holdings, and the allotment movement. Speaking as now an old-time political fighter for your industry I feel, and we have all felt, the political weakness of the fact that there are so few people in the boat. If we are going to keep that boat afloat, we must have more in it; and even if it means some self-sacrifices, as indeed it does on the part of the farmers to supply the wants of the new small-holding allotment, it is more than worth their while to meet them halfway if it has the effect of increasing the political strength of the Agricultural industry.

May I add one other factor? If the State is going to put on the land of this country a large number of men with limited experience and limited capital, they have to see that those men do not starve; and if they see that those men do not starve, in my humble judgment it will be the greatest security for the larger farmer that he will not stand the chance of starving either.

One word in conclusion. I do not know what Lord Lee's views may be about Government control. I have done a little bit of Government controlling myself. I hate Government control, and I hope that at any rate in the matter of prices Government control will cease as soon as possible. Nothing, in my judgment, tends more to stifle agricultural enterprise than the blighting process of Government control of prices, and this applies very especially to milk. I do not know what my agricultural friends here may think, but I

myself believe that if only the Government would leave milk alone—and it may possibly apply also to meat—milk would be far more plentiful than it is to-day, and possibly be obtainable by the populations of our towns at a lower price. That at any rate, my Lord, is my considered judgment, and I am pretty certain I am right.

The vote of thanks was seconded by Mr. Dent Brocklehurst. On being put to the meeting it was carried with enthusiasm.

AGRICULTURAL TRAMWAYS.

MANY farm tramways have been laid down in parts of England where the land is flat, and it is understood that they have been a commercial success. A brief description of these tramways may, therefore, be of value to farmers who are anxious to improve and cheapen their means of transport between the land and the main roads, wharves, or railway sidings.

These tramways consist of a light track, generally laid along the edges of the fields. No ballast is required as a rule, but if any can be cheaply obtained it may be desirable to use it on soft ground. The trucks are drawn by horses.

The advantages of such tramways will be seen when it is realised that one horse can haul along the level on rails a load of 10 to 20 tons as against 10 to 20 cwt. hauled by one horse with a farm cart in ordinary weather on farm roads. Bad weather which may prevent hauling on farm roads makes little if any difference to hauling on rails.

A sketch (Fig. 1) shows the style of lay-out recommended. On reference to the sketch it will be seen that the line has tracks running into all buildings and one to the railway station where loading and off-loading to the main-line trucks are carried out. Passing places are shown where loading would take place, so that any loads in transit can pass without interfering with the loading work.

Great care is required in laying out the sidings for transhipping goods from the tramway to the main line, as a great deal of unnecessary labour can be avoided by adopting a well-thought-out plan. Several examples are shown in Figs 1, 2 and 3.

Fig. 2 shows the simplest and most economical method, and allows for separate tracks for loading and discharging. Fig. 3 shows the detail and elevation. The system shown in Fig. 1 is more costly as regards the construction of the main-line siding and allows for only one tramway. Fig. 4 is a sketch of a tramway system actually in use on a farm in this country.

The permanent track used is generally 2 ft. gauge laid with rails of 14 lb. or 16 lb. weight per yd., on wooden sleepers,

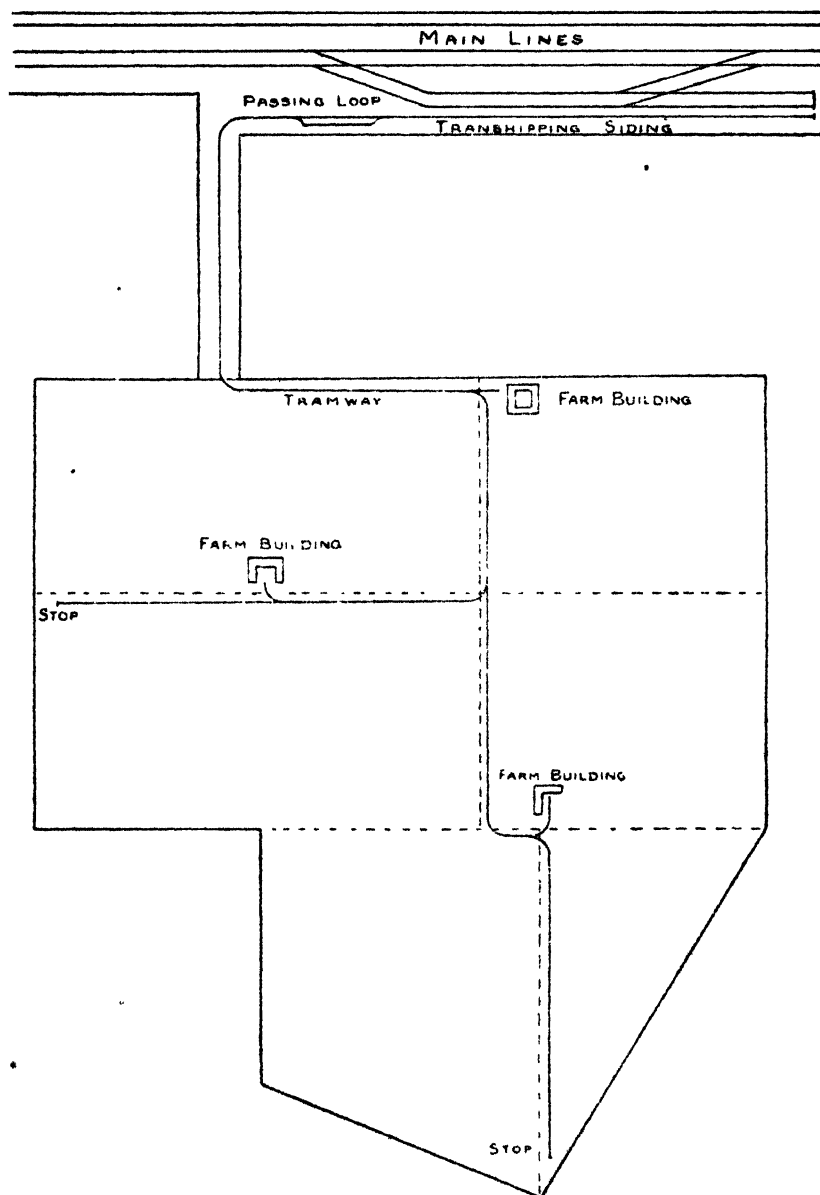


FIG. 1.—Typical Lay-out for Farm Tramway.

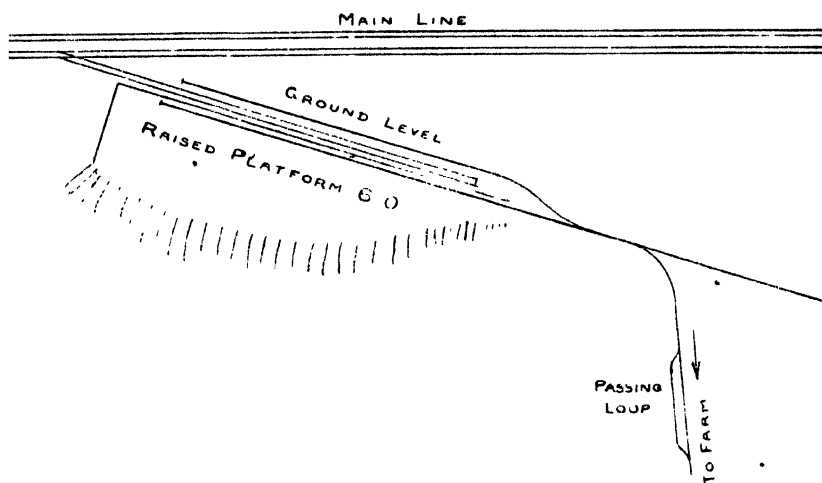


FIG. 2.—Detail of Station Lay-out.

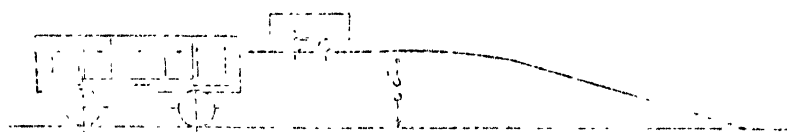
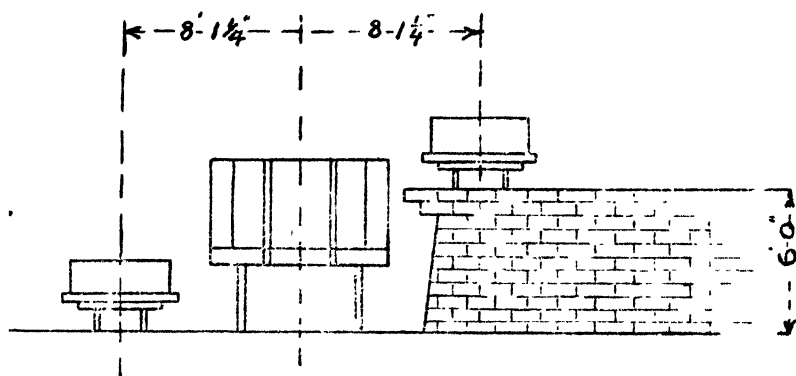


FIG. 3.—Detail showing relative Position of Farm Trucks to Main Line Trucks.

3 ft. to 3 ft. 6 in. long, placed 3 ft. apart. The rails are fixed to the sleepers by a single dogspike on each side of the rail, and are bolted in the ordinary way with fishplates and 2 bolts in each end.

For a temporary line a track of 9-lb. rails ready made up with steel sleepers may be used. Two men can lay 300 or 400 yd. of track in less than half a day. The usual method of laying is to place 10 or 12 lengths on a flat truck and push the truck to the spot required. The top two or three are then taken off and fixed in position. The truck is then pushed forward and the other lengths taken off and laid down, and so on until the truck is empty. The method of jointing the lengths is very simple. On one end of each, 2 fishplates are riveted on, with the ends projecting forklike about 6 in. To connect this end with the length already laid, the back end is raised about 6 ft. and the forked ends pushed in on either side of the laid rail until they pass under the bolt or rivet in the other rail. The back end is then lowered and, on reaching the ground, becomes locked to the preceding length.

Unskilled hands with a little guidance and with the use of a gauge can lay the track, but the laying of turnouts and sharp curves should be supervised by a skilled man, otherwise derailments will be of frequent occurrence, and the delay and damage incurred thereby will cost much more than would be spent in paying a skilled man for the short time necessary to set the curves and turnouts correctly.

The best type of wagon to adopt is the 4-wheeled flat wagon with roller bearings to the journals. These do not require so much attention as do those of the brass-bearing type, and they run more easily. The floor of the wagon is 1 ft. 6 in. above the rail level, and is 6 ft. 4 in. long and 5 ft. 6 in. wide. A wagon of these dimensions will hold $2\frac{1}{2}$ tons of sacked potatoes. One wagon in every four should have a brake fitted, but there is no necessity to adopt the expensive screwed spindle and taut arrangement: the simpler spindle and chain brake are sufficient for all requirements. Detachable sides are provided for the conveyance of farm produce that is not put up in sacks or bags.

The following table shows the reduction in the load (in tons) which it is possible to haul when a gradient is encountered, but much depends on the length of the gradients and the curves. The figures clearly indicate the importance of keeping gradients as low as possible.

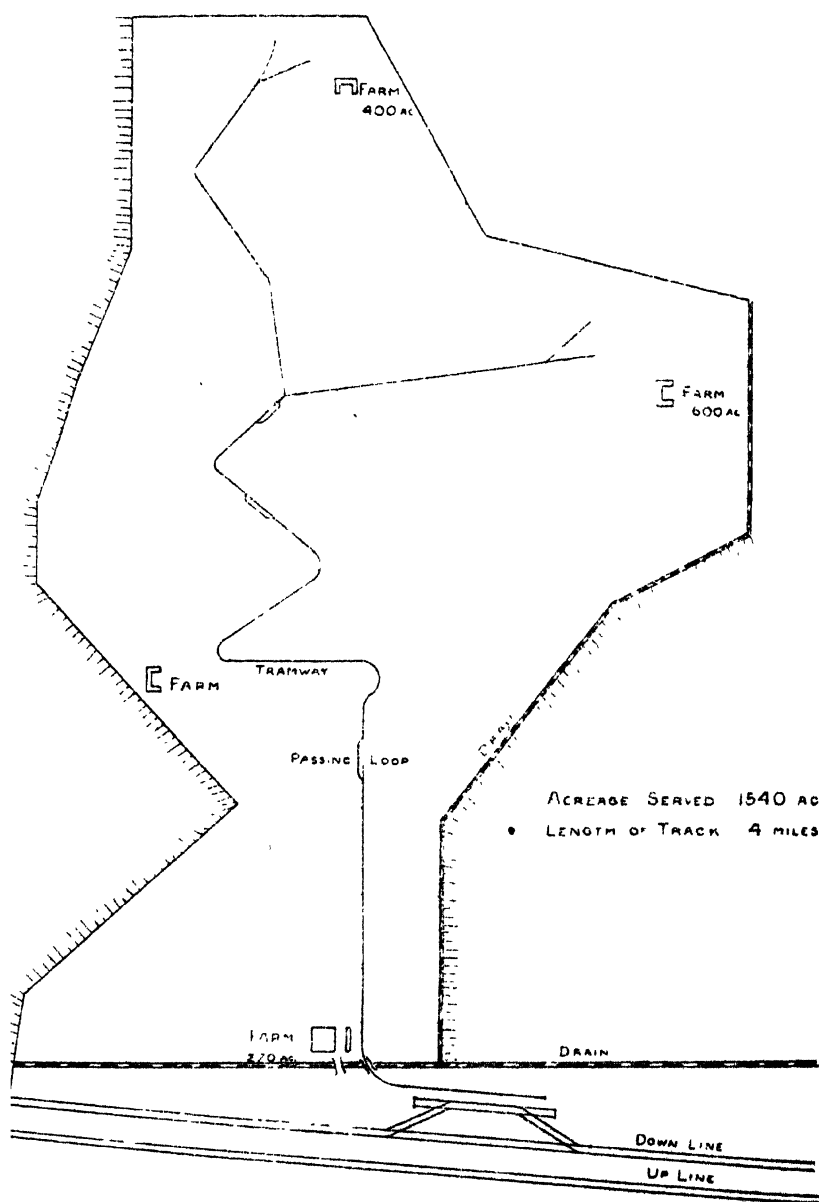


FIG. 4.—Farm Tramway at present in use.

The figures given are considered the maximum for one horse.

Level.	1 in 200	1 in 190	1 in 180	1 in 170	1 in 160	1 in 150	1 in 140	1 in 130	1 in 120
20 tons net	12	12	11½	11	10½	10	10	9½	9

1 in 110	1 in 100	1 in 90	1 in 80	1 in 70	1 in 60	1 in 50	1 in 40	1 in 30	1 in 20
8½	8	7½	7	6½	6	5	3	2	1

It will be found advantageous when a rise in the ground has to be negotiated to take it at an angle, so that the gradient of the track is reduced to a minimum.

THE TESTING OF SEEDS ORDER, 1918.

THE importance of instituting some measure of control over the seeds sold in this country has long been recognised. On the Continent, in America, and in the Colonies various regulations have been in force for a number of years for the purpose of preventing the sale of seeds of low vitality and seeds containing a dangerous proportion of weeds. The Testing of Seeds Order, 1917,* which came into operation on 1st January, 1918, brought the United Kingdom into line with these other countries in regard to the State control of seeds for sowing.

The main object of this Order was to protect the farmer against the danger of unknowingly purchasing and sowing seed of low vitality or contaminated with noxious weed seeds. No attempt is made to force the farmer to use seed of a better quality than that which he is ready to buy, but the aim is to compel the seller to disclose certain essential facts, so that the farmer can judge the value of the seed with a fair degree of accuracy.

* Printed in this *Journal*, December, 1917, p. 1031.

Most of the leading seedsmen in the country had made it a practice, before the Order came into force, to sell their seed on a guarantee as to its germination and purity, but the Order now regularises the guarantee and brings all sellers of seed into line with the more advanced and reputable firms.

The original Order was replaced on 1st July, 1918, by the Testing of Seeds Order, 1918,† which widened the scope of the previous Order, and made it applicable to all the principal kinds of cereals, grasses, clovers, roots and vegetable seeds. It requires that a Declaration as to the percentage of germination and purity, presence of injurious weeds and other specified particulars, shall be made in writing to the purchaser at or before the time of sale or delivery of the seed.

In the case of cereal seeds the Declaration may be made within a month of the delivery of the seed. This concession in regard to cereal seeds was found to be necessary to avoid the delay which would otherwise have arisen in handling seed for autumn sowing. Similarly, towards the close of the 1919 sowing season the Board issued a number of special licences authorising the delivery in advance of a Declaration in the case of certain lots of vegetable and clover seed, the threshing of which had been unavoidably delayed, or which had been imported late in the season. Otherwise, the making of the Declaration before or at the time the seeds to which it refers are delivered has been strictly required.

Despite the extra work entailed at a time when, owing to the demands of the Army, their staffs were seriously depleted, seedsmen throughout the country have, it is believed, done their utmost to carry out the requirements of the Order in its entirety, and the Board heartily appreciate not only the valuable assistance rendered by those representatives of the Seed Trade who helped to draft the Order, but also the loyal co-operation of the Seed Trade as a whole, without which it would have been impossible to administer the Order in a satisfactory manner.

The Order is acknowledged on all sides to have had excellent results. There are indications of a general levelling up in the quality of the seed on the market to the high grades for which our leading seed firms are justly noted. Such an improvement cannot fail to be reflected in the crops produced from this seed. The Order has driven off the seed market quantities of clover seed which, owing to its low germination and undue proportion of injurious weeds, had to be disposed of for feeding purposes. Grass seed has been sold for poultry feed,

† Printed in this *Journal*, July, 1918, p. 477.

and large quantities of root seeds have been sold for crushing. Had it not been for the Declaration as to quality required by the Order, much of this low-grade seed would have been thrust on to the unsuspecting farmer for sowing, and must have resulted in disappointing crops.

Farmers should note, however, that this Order not only gives them a very important measure of protection against purchasing, unsuspectingly, low-grade seed from a seedsman, but requires them also to observe its provisions in transactions between farmer and farmer. For instance, a farmer growing clover for seed must have a sample tested, and make the necessary Declaration, in the case of a sale of this seed to another farmer. Large quantities of seed, particularly cereal and clover seed, are sold by one farmer to another, and as few farmers have the machinery and appliances commonly used by all up-to-date seedsmen for cleaning and grading seed, it naturally follows that these transactions are responsible for the spread of a large proportion of injurious weeds, which, in the aggregate, cause an enormous annual loss to the farming community. When it is considered that 1 per cent. of European Dodder in one pound of Clover seed represents some 18,000 seeds of this weed, it will be realised how necessary it is to be sure that the seed is properly cleaned before it is sown. Unfortunately, the germination of noxious weed seeds is usually high, often higher than that of the sample containing them. If, for example, a mixture of 20 lb. of Rye-grass and 10 lb. of Red Clover, contaminated with only 2 per cent. of injurious weed seeds, were sown to the acre, and if only half of these seeds germinated, and again if only half of those which germinated produced plants, the result would be that 14 weeds would be introduced into every square yard of the field.

Under the Order it is necessary for the farmer or the seedsman, when selling seed, to declare the presence of noxious weeds if they are present to an extent of more than 1 per cent.

Administration of the Order.—Whilst the Testing of Seeds Order was issued under the authority of the Food Controller, the duties of administration, so far as England and Wales are concerned, have been vested in the Board of Agriculture and Fisheries. The system of inspection adopted in connection with the enforcement of the Order consists in visiting markets, the premises of seed merchants and of farmers who have seed for sale, etc. The main purpose of these visits is to give information as to the requirements of the Order, to

ascertain whether the Order is being complied with, and to draw control samples, which are forwarded to the Official Seed Testing Station in order to check the particulars declared by the seller.

Up to 31st July, 1919, some 2,450 seed firms had been visited, many of them on two or three occasions. Appreciation of the assistance given by Inspectors in explaining the Order is frequently expressed by the firms visited; in no case has any serious difficulty been met in connection with the taking of control samples.

The number of control samples taken during the 1918-1919 season has been as follows :—

285 samples of root seeds.	
530	„ „ clover „
320	„ „ grass „
23	„ „ field „
22	„ „ cereal „
449	„ „ vegetable „
<hr/>	
Total 1,637	

In addition to the above, some 2,200 small packets of seed have been obtained by the Board's Inspectors in connection with a special inquiry into the quality of seed sold in this manner.

All the samples drawn from bulks by official samplers are sent to the Official Seed Testing Station for check tests to be made, for comparison with the particulars declared by the person on whose premises the sample was drawn.

When the Order first came into force, the Board gave an undertaking that, with a view to allowing seedsmen ample time to become acquainted with the new regulations, and to make the necessary arrangements to meet the extra clerical work involved by the Declarations, the Order would not be administered in a penal fashion for the first year or so. Acting on this pledge, no attempt has been made by the Board to institute legal proceedings for breaches of the regulations.

In any case where it has been found that the Order was not being observed, the attention of the seedsman in question has been drawn to the fact, and, so far as it is possible to ascertain, this has been sufficient to cause the particular omission to be rectified. Similarly, in any case where the results of the official tests on control samples have differed considerably from the seedsman's Declaration, the matter has been taken up with the firm concerned.

Of the 1,637 control samples, only 88, or about 5 per cent., gave results which showed the Declarations to be radically wrong. These comprised 4 samples of root seeds, 39 of clover, 31 of grass, and 14 of vegetable seeds.

In most cases, as soon as the discrepancy was brought to the notice of the firms concerned the seed was either withdrawn from sale or returned to the wholesaler, or the Declaration was corrected to correspond with the result of the official test.

A difficulty to be reckoned with in comparing the results of check tests on control samples is the practical impossibility of making a perfect mixture of seeds, so that every hundred seeds will contain the same number of dead seeds or weed seeds. Specified margins of latitude are set out in the Order to cover these discrepancies, and detailed particulars are given as to the method of drawing a proper sample. This is sufficient in cases where the bulk of the seed is fairly pure and the majority of the seeds are viable, but where the bulk varies in quality the possibility of error increases in like proportion.

An interesting case of this kind occurred early in the current year. Official tests on a control sample of Rye-grass seed taken on the premises of a retail seedsman gave an average germination of 38 per cent., as against the retailer's Declaration of 92 per cent. When this discrepancy was brought to his notice, the retailer returned the seed to the wholesale merchant from whom he purchased on a guarantee that it would grow 92 per cent. The wholesaler then protested that the figure he declared was the accurate result of a test carried out in August, 1918, and, furthermore, that tests made since the seed had been returned by the retailer gave an average germination of 72 per cent. Control samples taken from each of the bags remaining unsold showed, however, that the seed was of a very uneven quality, the germination of the various bags ranging from 74 per cent. down to 14 per cent. Had it not been for the activity of the official sampler in this case, it would have resulted in a farmer purchasing a quantity of this seed on a Declaration that it germinated 92 per cent., whereas in certain cases it would have only grown 14 per cent.

The plea put in by many retailers when an inaccuracy in their Declaration has been pointed out to them is that they were repeating the Declaration of the wholesaler from whom they purchased the seed in question, and that they considered that any action taken by the Board should be directed to the wholesaler. The Order requires that in the case of a sale of

seeds certain specified particulars must be correctly declared by the seller. The responsibility as to the accuracy of the Declaration in the case of a retail sale therefore rests with the retailer. In practice the particulars given by the wholesaler are frequently relied on and repeated by the retailer, but in his own interests it is advisable that the retailer should check the accuracy of these particulars by having tests made on his own behalf. The Declaration given by the wholesaler is probably accurate at the time he delivers the seed to the retailer, but it would obviously be unfair that the responsibility as to the continued accuracy of his Declaration should hold good indefinitely after the seed has passed out of his control.

Some of the points in the Order which are most frequently misunderstood are covered below.

Declaration required in the Case of "Mixtures."—When selling seed "mixtures," particularly such a mixture as Alsylke and White Clover, seedsmen sometimes declare the germination of the whole only. It should be noted, however, that this is permissible only in the case of a blend of the same varieties—for instance, in a blend of Chilian, English and French Red Clover, provided the different countries of origin are stated, particulars as to percentage of germination, etc., may be given in respect of the blend as a whole. In all other cases of mixtures of grasses and clovers, however, the particulars required by the Order must be declared in respect of each kind of seed in the mixture, and the proportion by weight of each must also be stated.

Declaration required in the Case of Seeds exposed for Sale.—One of the most frequent breaches of the Order up to the present has been the omission to display the necessary particulars on seeds exposed for sale. The general excuse is ignorance of this requirement of the Order, but it is difficult to believe that anyone who is carrying out the more troublesome task of making the necessary Declaration in the case of a sale should be unmindful of the need to label the seeds exposed in his shop. In some cases seedsmen have assumed that seeds shown as "shop window dressing" are not covered by the Order. Unless a clear indication to the contrary is given it would be held that these seeds were exposed for sale, and, therefore, that the particulars required by the Order should be displayed in connection with them.

It should also be noted, in this connection, that the mere production for inspection of the particulars necessary under

the Order is not a compliance with the Order in the case of a sale, and that something in the nature of an invoice is required to connect the particulars with the article sold.

Non-warranty Clause.—The attention of the Seed Trade has been called to the apparent contradiction of the terms of the Declaration required under the Order, which occurs when seedsmen print on their invoices, billheads, etc., the so-called "non-warranty clause." The following amended form of words, has, however, now been suggested by the Agricultural Seed Trade Association, and accepted by the Board:—

"Messrs, _____ give no warranty, express
"or implied, as to description, quality, productiveness,
"or any other matter, *beyond the analysis required in*
"*accordance with the Testing of Seeds Order, 1918.* of any
"seeds they send out, and the seller will not be in any
"way responsible for the crop. If the purchaser does not
"accept the goods on these terms they are at once to be
"returned."

Name and Address of Seller on small Packets of Seed.—Some misapprehension has arisen in this connection, but it should be understood that the intention is that small packets of seed should bear the name and address of the seller. Whether the name and address is that of the wholesaler or the retailer is, however, immaterial.

Declaration of Date of Test.—According to the Order, the date of the test need not necessarily be declared if it has been carried out within six months of the sale of the seed. If, however, seed is sold more than six months after a test, the month and year of the test must be declared, or, alternatively, a retest must be carried out.

In order to obviate the necessity of a seedsman keeping track of a particular parcel of seeds, so that he may not sell on a more than six months' old test without declaring this fact, it is suggested that the form of words used might be "tested since September, 1919," or whatever the month in which seedsmen commence testing.

Retailers who base their own Declaration on the Declaration supplied by the wholesaler from whom they purchase the seed are advised to ascertain the date of the wholesaler's test; otherwise they may be basing their Declaration on a test more than six months' old.

Declaration in Cases where Seed is below the Standard specified in the Order, but within the Margin of Latitude laid down.—Cases have been brought to the notice of the Board where a sample of

seed has been declared to be "at or above the standard of germination specified in the Testing of Seeds Order," when, in fact, the test showed it to be below that standard, but within the margin of latitude laid down in the Order. The purpose of the "margin of latitude" is to allow for a reasonable discrepancy between tests made on different samples of the same bulk, and cannot properly be taken advantage of in the above circumstances.

Imported Seed.—It should be understood that the Order applies to imported as well as home-grown seed, and that the importer is responsible for having imported seed tested, and for making a Declaration as to the percentage of germination, purity, etc., at the time of sale or delivery. It sometimes happens that the importer wishes to sell and deliver a parcel of imported seed direct from the port of arrival to a number of purchasers. If he can show adequate reason for not having this seed tested before it is despatched, the Board will be prepared to issue him a licence on certain conditions, authorising him to deliver in advance of the necessary Declaration.

"Hard" Seed.—It is found necessary from time to time to draw seedsmen's attention to the fact that the percentage of "hard" seed must be declared separately from the percentage of seeds which germinate during a germination test.

Some seedsmen make it a practice when sending out "offers" of seed for sale to include "hard" seed in what is described as the "germinative value," but bring themselves within the law by stating the percentage of "hard" seed separately when a sale is effected. This procedure is clearly most undesirable and misleading.

Small Packet Inquiry.—A special inquiry regarding the small packet trade has been conducted during the past season. Some 2,200 packets have been collected by the Seed Inspectors and forwarded to the Official Seed Testing Station for examination and testing.

The practice of some firms of selling quantities of small packets outright leads in many cases to the seed being kept over for a year or more by the retailers, sometimes under most unsuitable conditions, with the result that considerable deterioration takes place. In several instances old packets have been purchased by Inspectors and found on testing to germinate below 10 per cent. Some packets have proved to contain dead seed only. When the Order is revised, it is proposed to require the date on which the seed was packed

to be stamped on the packet, and it is hoped in this way to prevent the sale of old and useless seed.

Apart, however, from old seed, the results of the inquiry show a wide variation in the quality of the seeds put up by the firms which make a speciality of this class of trade.

The following is a summary of the results of tests carried out on packets of seed supplied by seven firms of packeters. As the past season was the first in which the packet trade has been subjected to an investigation, it might be unfair to give the names of the firms concerned.

It should be mentioned that the percentage of germination was marked on a very small proportion of the packets examined, so that the majority were sold under an implied guarantee that the seed was above the standard specified in the Order.

Firm.	Number of Packets tested.	Percentage above Standard.	Percentage below Standard but above two-thirds.	Percentage below two-thirds of Standard.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
A ..	295	73·9	22·7	3·4
B ..	124	78·2	9·0	12·8
C ..	103	79·6	16·5	3·9
D ..	50	88·0	6·0	6·0
E ..	31	54·8	32·2	13·0
F ..	56	76·8	19·6	3·6
G ..	53	79·2	9·4	11·4

The results of the inquiry as they affect some of the principal seeds are given in the following statement, from which it will be seen that a material proportion of the parsnip, onion, and carrot seed germinated below two-thirds of the standard.

Kind of Seed.	No. of Packets tested.	Standard specified in Order.	Percentage up to and above Standard.	Percentage below Standard but above two-thirds.	Percentage below two-thirds of Standard.
			<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Turnip ..	112	80	96·4	2·7	0·9
Carrot ..	203	60	79·8	13·8	6·4
Parsnip ..	106	50	63·2	18·0	18·8
Onion ..	190	65	69·4	22·1	8·5
Beet ..	126	100	70·7	24·6	4·7
Cabbage ..	165	75	73·3	22·4	4·3
Broccoli ..	93	75	75·3	22·6	2·1
Cauliflower ..	76	70	71·0	25·0	4·0

It is proposed to continue the inquiry into the packet trade during the forthcoming season, and, in addition to testing the germination of the seed, it is intended to tabulate the quantity of seed contained in the packets. Considerable variation in the quantity of a particular variety of seed put up at a uniform price by various firms was noticeable during the recent inquiry, but pressure of work would not permit these variations to be checked and tabulated.

Testing of Seeds in the Future.—The Testing of Seeds Order is one of the measures passed under the Defence of the Realm Regulations, and as it is desirable that provisions on these lines should be made permanent, steps are being taken to introduce legislation for this purpose. A draft of the proposed Act is now being prepared by the Board in consultation with leading representatives of the Seed Trade of the United Kingdom. It is, however, unlikely that the Act will come into operation before the 1st August, 1920, and it is, therefore, proposed that the existing Order shall remain operative throughout the 1919-20 season.

THE AMMONIUM POLYSULPHIDE WASH.

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In previous communications* the writers have pointed out that the ammonium polysulphide wash, used with a soft-soap solution, is efficacious against "powdery mildews" (*Erysiphaceæ*). It is particularly useful for spraying parts of plants, such as fruits, since it leaves, on drying, no visible deposit; it is consequently valuable for protecting ripening dessert gooseberries from the American Gooseberry Mildew.

As the result of investigations carried out over a number of years in the Research Department of the South-Eastern Agricultural College, at Wye, it has been found that the fungicidal strength of the ammonium polysulphide wash can be accurately determined by ascertaining the percentage of the polysulphide sulphur that it contains. The concentrated solution recommended in the last note† contained 13.6 per cent. of polysulphide sulphur; diluted for use as a summer wash at the rate of 1 part to 99 parts of water, the percentage of polysulphide sulphur would be 0.136. Further experiments, however, have shown that 0.11 per cent. polysulphide sulphur is fungicidal.

Continued investigations during the winter of 1918-19 resulted in the discovery of a method of making a stable concentrated solution containing as much as 21.0 per cent. of polysulphide sulphur. Theoretically, such a solution, when diluted 1 part to 199 parts of water (and thus containing 0.11 per cent. of polysulphide sulphur), should prove fungicidal for the "powdery" conidial stage of mildews. In a number of experiments with the conidial stage of the Hop Mildew (*Sphaerotheca Humuli* [DC.] Burr.), the details of which will be given elsewhere, it was actually found that this was the case.

It may be pointed out, therefore, that there now exist three formulæ by which the concentrated ammonium polysulphide solution can be made, viz., the one given in 1916†, which can be diluted 1 in 20; the "A.P.S., 1918,"‡ to be diluted 1 in 100.

* See this *Journal*, February, 1916, p. 1118, and March, 1919, p. 1494.

† " " February, 1916, p. 1118.

‡ " " March, 1919, p. 1496.

and the "A.P.S., 1919" (given below), to be diluted 1 in 200. It must be left to the manufacturer, working under factory conditions, to choose the one which is most economical, or possibly to find one capable of still greater dilution. *A guarantee of the percentage of polysulphide sulphur which the diluted wash contains (which should be 0.11 per cent.) should be obtained by the purchaser from the manufacturer.**

For details as to the manner of using the ammonium polysulphide wash, reference may be made to the article by the writers published in the issue of this *Journal* in March last (p. 1494).

"A.P.S., 1919."—This solution was prepared in the following manner: A current of sulphuretted hydrogen gas was passed through a mixture of 1000 cc. of strong ammonia solution (sp. gr.—0.880), 300 cc. of distilled water and 400 grams of flowers-of-sulphur, until all the sulphur was dissolved. The flask containing the mixture was occasionally shaken, and at the end of $46\frac{1}{2}$ hours all the sulphur was in solution. The specific gravity of the dark red liquid formed was 1.024 at 12° C. and the volume 1515 cc. To this liquid 250 cc. of strong ammonia solution (sp. gr. 0.880) were added and the resulting fluid formed the stock solution A.P.S., 1919.

The total sulphur present in this solution was found to be 28.4 per cent., of which 6.5 per cent. was present as sulphide-sulphur and 21.9 per cent. as polysulphide sulphur. The solution contained 19.6 per cent. ammonia (NH_3), and the sp. gr. was 1.018 at 12° C.

Dilution.—To prepare the diluted wash from the stock solution, 5 lb. of soft soap are dissolved in $99\frac{1}{2}$ gal. of water, and into this soap solution $\frac{1}{2}$ gal. of stock solution A.P.S., 1919, is mixed by stirring. In this manner 100 gal. of wash are prepared, ready for use, containing 0.5 per cent. of soft soap. Two applications should be given, at an interval of a week or ten days.

* It may be mentioned here that the diluted wash of the 1916 formula contains only 0.075 per cent. polysulphide sulphide; since, however, washes containing 0.11 per cent. polysulphide sulphur have been used in subsequent experiments to a greater extent and under more diverse circumstances, it seems advisable to take the percentage 0.11 as the requisite amount of polysulphide sulphur in the diluted wash.

PEACH leaf-curl has been known in Britain for upwards of a century, and in certain seasons proves very destructive to peaches and nectarines and, more rarely, **Peach Leaf-Curl.** to almonds. It occurs constantly where these plants are grown in the open, but is much less prevalent on trees grown under glass. The disease is by no means confined to this country, but is found in all parts of the world, occurring almost wherever the peach and its allies are grown.

Description of Symptoms.—The disease appears in the spring shortly after the leaves begin to emerge from the bud. The leaf-blade becomes thickened and puckered along the mid-rib, causing the leaf to become curled and twisted. The diseased part remains yellowish in colour with a tinge of red in it. As the leaves become older, this curling and crumpling of their surface becomes more pronounced; their substance becomes fleshy and the coloration darker; finally the upper surfaces of the diseased leaves become covered with a delicate silvery bloom, due to the fungus passing into its spore-bearing stage. Affected leaves finally die and drop from the tree, and in severe cases the entire tree may become defoliated. New sets of leaves, however, usually develop and replace those which have fallen.

The fungus not only attacks the leaves but also invades the young shoots and, more rarely, the flowers and fruits. Young shoots infected with the fungus become swollen and twisted and the diseased leaves usually form a tuft on a stunted shoot owing to the internodes failing to elongate.

In winter, symptoms of fungal activity are visible on the young growth, brown patches being present here and there; these patches increase in size, until finally the whole length of the lateral beyond this point withers and a number of dead ends are left.

The injury caused by the disease consists not only in the distortion of the leaves and premature defoliation but in the dropping of the fruit at an early stage and the strain on the tree due to the development of a second crop of leaves. In the case of nursery stock, consecutive attacks for three or four seasons usually kill the tree or stunt its growth to such an extent that it is practically valueless.

Cause of the Disease.—Leaf-curl is caused by the attack of a fungus *Exoascus deformans*. The fungus enters the young leaves early in the spring when the buds are just commencing

to expand. The mycelium (or system of fine fungus threads) develops between the cells of the leaf, robbing them of nourishment, destroying the green colouring matter and causing the leaf to become deformed.

After a time the fungus mycelium forms a layer just beneath the skin of the leaf, and from this layer a number of spore-sacs (termed asci) are developed; it is their presence which causes the silvery bloom upon a diseased leaf. Within each of these spore-sacs eight spores are produced, and these spores usually bud off a number of secondary spores, all of which are capable of germination and reproducing the disease when they are liberated and fall upon a fresh leaf. The spores are produced in great abundance upon the diseased leaves during the spring and early summer.

Commencement of Attack in Spring.—It was long believed that the fungus mycelium hibernated in the tissues of affected shoots and during the succeeding spring grew up into the expanding leaflets and produced disease. Later observation, however, has shown that this is of comparatively rare occurrence. Such facts as are at present available tend to show that fresh infection of the leaves in the spring always takes place by means of spores which have lain dormant during the intervening months, entangled among the scales upon the buds.

The establishment of a new outbreak of disease by these spores is intimately connected with the weather conditions which prevail at the time. Cold, wet weather, just when the leaves are expanding, causes them to become abnormally gorged with water and much more susceptible to an attack by the fungus. It is a widely observed fact that leaf-curl is very much less prevalent in a uniformly warm and dry spring, and it has also been noticed that where infection has occurred a return of warm, dry weather, or even the occurrence of a hot, dry wind, will check the development of the fungus within the tissues. Peach trees planted near large expanses of water, where the atmosphere is moister and cooler than elsewhere, have been found to be especially liable to the disease.

Control.—Leaf-curl may be very effectually controlled by thorough spraying with either Bordeaux or Burgundy mixture. It is essential, however, that the spray be applied before the buds begin to swell in the spring. This time will range between the middle or latter part of February and the beginning of March, according to the locality and the nature of the season. A Burgundy mixture of the following composition has been used

with excellent results at the Royal Horticultural Society Gardens, Wisley* :—

Copper sulphate, $2\frac{1}{2}$ lb.
Sodium carbonate, $2\frac{1}{2}$ lb.
Water, 12 gal.†

The copper sulphate (98 per cent. purity) and the sodium carbonate should be dissolved in separate wooden vessels, and when completely dissolved, mixed together.‡ One spraying, just before the buds open, is usually sufficient, but a second spraying gives additional assurance of success. Great care should be taken to ensure that the buds are completely coated with a film of the mixture. Before spraying, all dead twigs and any obviously diseased shoots should be cut away.

(This note is also issued as Leaflet No. 120. Copies may be obtained gratis and post free on application to the Secretary, Board of Agriculture and Fisheries, 3, St. James's Square, Westminster, London, S.W. 1.)

* See Horne, A. S., *Jour. Roy. Hort. Soc.*, Vol. XLI. (1915), pp. 110-114.

† If a small quantity of the mixture is required the proportions would be :—

Copper sulphate, $9\frac{1}{2}$ oz.
Sodium carbonate, 11 oz.
Water, 3 gal.

‡ For fuller details regarding the methods of preparing Burgundy or Bordeaux mixtures, see Leaflet No. 23. Copies may be obtained gratis and post free on application to the Board.

THE work of the Rothamsted Experimental Station in the investigation of problems having a scientific bearing on agriculture is well known. Rothamsted has acquired a reputation throughout the world for her contributions in the matter of research work, especially in regard to soil and plant nutrition problems. Recognition of the value of this work is shown in the extension and improvement of the laboratory equipment of the Station, which has recently been undertaken. This should help considerably in increasing the usefulness of the already valuable work which is being done. The new laboratories were opened on 20th October, in the presence of a large number of agriculturists and scientific men.

The opening ceremony was performed by the Parliamentary Secretary to the Board of Agriculture and Fisheries (Sir Arthur Griffith-Boscawen). In the course of his remarks the chairman (Professor H. E. Armstrong) said that Rothamsted has been known throughout the world as the head centre of scientific inquiry into the problems of agricultural practice. The absolute dependence of cereals on nitrogenous manures was first established there and wheat had been grown continuously on the same land, on the far-famed experimental plots, since 1843, a period of 76 years. Hence it is now the Mecca of agricultural pilgrims. The first laboratory was a converted barn; this was in use from 1843 until 1854. The work done by Lawes and Gilbert during this early period was so obviously to the benefit of agriculture that the farmers of England subscribed funds for the erection of a proper laboratory. This was built in 1853-54, and occupied the site of the new building declared open that day. The total cost of the improvements had been £26,000. No less than £10,000 was collected in public subscriptions from farmers and their friends. The Board of Agriculture gave generous assistance by granting an equal sum from the Development Fund. The remaining £6,000 was given by private donors. Most fortunately, the work was completed before the recent rise in prices; at a conservative estimate it could not be done now for less than £60,000. The Trust Committee was greatly indebted to the Director of Rothamsted, Dr. E. J. Russell. Fortunately, by a recent decision of the Board of Agriculture, a new department of plant pathology, including entomology, had been placed under the control of the Lawes Trust. The workers were to find temporary accommodation in the new laboratories with which

they were concerned that day, but plans for a special building for the new department were under consideration, and it was hoped that this would be erected at an early date. Rothamsted would, therefore, afford very special opportunities, and should take high rank in the future, not only as a centre of advanced scientific inquiry but as a post-graduate training school for leaders of agricultural practice. His personal opinion of the future of British agriculture was that it lies in milk and meat. We were only beginning to appreciate the vast importance to the nation of a full supply of pure milk, fresh and undiluted, and, therefore, it would be impossible to deal with the problems of agriculture without, at the same time, considering both animal and vegetable nutrition. If we were to produce crops of maximum value as foodstuffs, we must be free to study their effects on animals—if only in memory of the immortal service to mankind rendered by Sir John Lawes.

Sir Arthur Griffith-Boscawen then proceeded to open the laboratories. During the War, he said, the Government had realised the national importance of agriculture, and he knew that it was the intention of Government and the Prime Minister that agriculture should not be neglected in the future as in the past. There were several ways in which the Government could help them. They could assist agriculture by guaranteed prices over a period of years, by better transport, improved methods of organisation, co-operation in marketing, and buying in bulk; but one uncontroversial way was by the application of greater scientific knowledge to agriculture. It was this knowledge they wished to see carried through, so that even if the Government and Parliament did not treat agriculture as they should, by such institutions as Rothamsted knowledge would be disseminated throughout the agricultural world. The State was now spending quite a respectable sum in agricultural education and research, and we had now a far better system of agricultural education and research than ever before. Experts were advising farmers, and farm institutes and colleges where scientific knowledge could be acquired had been established. Demonstration farms were largely increasing, and were of the greatest value, because they proved on strict and commercial lines the value of the new processes. The British farmer was rather a conservative person, and unless he was shown that "there was money in it" he was apt to be sceptical. But the fountain head of the whole thing was the research station, and it should be remembered that the new laboratory to be opened that

afternoon was only leading up to another building where important fundamental work on plant pathology would be carried through.

Need of Lime.—This is the time for putting on lime. The need is in many cases great : evidence on this point is accumulating from all parts of the country. This

**Notes on Manures
for December :**

*From the Rothamsted
Experimental Station.*

is essentially one of the problems that may be better solved by a co-operative society than by individual farmers, and undoubtedly it would be a wise step for farmers' clubs and unions to devote some of their activities to work in this direction.

The following is a typical case with which we have been called upon to deal during the past month. A farmer who had always been in the habit of doing his land well and obtaining good crops, wrote to say that he had suffered loss on his seeds crop (grass and clover mixture) through giving top-dressings of sulphate of ammonia to the wheat in which the seeds were sown. Being anxious to continue the use of sulphate of ammonia for wheat, and knowing by experience that satisfactory increases in the wheat crop were obtained thereby, he asked whether there was any means of avoiding injury to the seeds, which, naturally, he could not afford to incur. The sulphate of ammonia had been applied in the second or third week in March, and the seeds (a two-years mixture) sown at the end of April. On another part of the farm, however, there had been no such trouble, and the application of sulphate of ammonia to the wheat had not depressed the growth of the seeds mixture.

Inquiry showed that the wheat crop, while good, had not been sufficiently dense to smother the young seeds, as has sometimes been the case in our experience. Examination of the soil was therefore made. It was found that the part of the land where the seeds had failed was acid ; the part where they had succeeded was not acid. Now it is known that sulphate of ammonia is injurious to certain crops on acid soils, though it does no injury, but, on the contrary, has beneficial effects, on neutral soils. Among the crops most affected on acid soils are clover, turnips, and barley.

Further inquiry has shown that the trouble is not uncommon, and that attempts to increase the corn crop by spring dressings of sulphate of ammonia may be injurious to the seeds mixture if the soil is acid.

Fortunately the remedy is quite clear. A dressing of lime or of ground limestone must be applied. Without examination it is impossible to say exactly how much is needed in each particular case. Farmers fearing trouble in this direction would do well to communicate direct with the Agricultural Organiser of the county in which they reside, and wherever the trouble is at all widespread they should consider the possibility of forming a liming society, whose business it would be to organise the examination of the soils, the purchase and distribution of the lime or limestone, etc. Where there is any danger of acidity, nitrate of soda or nitrate of lime is a better agent to use as a top-dressing for corn in which seeds are sown.

Nitrate of Soda.—There is now much better prospect of obtaining nitrate of soda than there has been for many months. Arrangements have been made whereby some 50,000 tons of nitrate of soda will be available for British farmers during the coming season at a price of £20 to £22 per ton according to locality, this price comparing favourably with that at which sulphate of ammonia can be obtained. The quantity is somewhat less than was consumed in pre-war days, but it is vastly in excess of anything the farmer has been able to obtain during the War.

In addition to the natural nitrate there is now the likelihood of obtaining artificial nitrate of soda of 96 to 97½ per cent. purity from Norway. So far as we are aware none of this is coming over at present, but the material can be made.

Quality of Basic Slag.—Numerous inquiries are made as to the difference in value of the different grades of basic slag. There are three distinct types of slag, which must on no account be confused :—

1. Bessemer slag containing phosphoric acid equivalent to 40 per cent. or more of tricalcic phosphate, largely soluble in 2 per cent citric acid ; usually 80 per cent. of the total is guaranteed soluble.
2. Basic " open-hearth " slag containing less phosphoric acid, equivalent to 15 to 31 per cent. of tricalcic phosphate, largely soluble (80 per cent.) in 2 per cent. citric acid, the first pourings being richer than the last.
3. Basic " open-hearth " slag made by the use of lime and fluorspar, containing as much phosphate as the poorer grades of the preceding class, but only slightly soluble (20 per cent. or less) in 2 per cent. citric acid.

The first of these types, the Bessemer slag, is the material which for many years was well known to agriculturists as one

of the most effective of fertilisers for pasture land. The second and third types have come into prominence in recent years, and especially during the War, as the result of changes in the method of making steel. At first sight they are not very promising agriculturally, but field experiments have shown that they possess distinct value. They have been tested in Northumberland by Gilchrist, in Essex by Scott-Robertson, in Devon by Dutton, and at Saxmundham by Oldershaw. The second class have proved substantially equal in fertiliser value to the old Bessemer slags when compared on equal phosphate content. The third class have proved more effective than was at first assumed from their low solubility in citric acid. Where the growing season has been sufficiently long these slags are approximately as useful as the others, in spite of their low solubility. Where the growing season is shorter or an early start more necessary the high soluble slags have proved more effective.

The question has recently been raised whether a 40 per cent. slag is worth a high price in comparison with a 20 per cent. slag. It is sometimes claimed that the 20 per cent. slag is as good as the other in nine cases out of ten, and that there is, therefore, no point in paying an excessive price for slag which may be no better. This assumes that the value of the slag lies not in its phosphates, as is usually supposed, but in some other constituents. There is insufficient evidence to say whether other constituents do or do not help the growing crop, and it is always possible that they may do so. There is no doubt a good deal to be learned about these new slags, and investigators have not yet had the necessary time to test them as thoroughly as is desirable. On present knowledge, however, it is safest to adopt the old plan of judging the new slags, like the old, on their phosphatic content, and buying them on their value according to the unit system, insisting on the proper degree of fineness of grinding. On this basis, a 40 per cent. slag is worth twice as much as a 20 per cent. slag, together with such sum as will pay for the difference in cost of handling a small as compared with a large bulk of material. Having allowed for this, however, there is probably no justification for paying more for the 40 per cent. slag, and certainly not for paying any fancy price.

Purchase of Mixed Manures.—There are certain advantages in purchasing manures ready mixed for various crops; the farmer is saved the trouble of weighing out and mixing the constituents; and often the compound manure is in better

condition and more easily drilled than the home-made mixture, unless considerable care has been exercised. These advantages should not be bought too dearly, and farmers should always satisfy themselves that they are not paying too much for the resulting saving in trouble.

An instance is offered by a recent correspondent. He was offered a potato manure at £19 per ton, containing the following constituents :—

Nitrogen	.. ..	6½ per cent.,	equivalent to ammonia
			7 per cent.
Soluble phosphates	.. . 20	..	
Insoluble phosphates	.. 2½	..	
Potash	.. ..	4½ ..	equivalent to sulphate of
			potash 8 per cent.

There is nothing to be said against the proportions, but it should be noted that a manure of the same composition could be made for £13 per ton, by using sulphate of ammonia, superphosphate and sulphate of potash. This figure is arrived at in the following way :—

One ton of the manure contains—

7/100 tons ammonia,	equivalent to 2/7 ton sulphate of ammonia,
20/100 .. phosphate	.. 2/3 ton 30 per cent. superphosphate,
8/100 .. sulphate of potash	equivalent to 4/45 ton sulphate of potash,

at the following prices (October, 1919) per ton—

	£	s.	d.
Sulphate of ammonia (24½ per cent. ammonia) ..	20	10	0
Superphosphate (30 per cent. soluble)	7	13	0
German sulphate of potash (90 per cent. K ₂ SO ₄)	23	2	6

The price of the home-made mixture would be—

	£	s.	d.
5½ cwt. Sulphate of ammonia	5	17	10
13½ .. Superphosphate	5	1	8
1½ .. Sulphate of potash	2	0	6

20½ cwt. £13 0 0

Of course, if the purchaser were buying small quantities only, or not paying cash, he would have to pay higher prices for the separate ingredients, and a further payment would have to be made if the mixing were done by a firm. Allowance must be made for these items. Farmers and co-operative societies, however, should ensure that they do not pay too much for their mixed manures.

IN 1913 a Committee was appointed by the Secretary of State for the Home Department "to inquire what action has been taken under the Wild Birds' Protection Act, and to consider whether any amendment of the law or improvements in the administration are required." The deliberations of the Committee were interrupted by the War, but a Report* has now been presented, and as it contains much of interest to farmers and landowners the following notes may be of service.

The Report begins by stating what the main objects of legislation should be :

1. Birds that are rare or harmless, or are positively valuable because of their utility or beauty or the beauty of their song, should be protected as far as possible.
2. Farmers, gardeners and preservers of game and fish should be allowed to protect their interests against injurious birds.
3. The creation of a large number of petty offences should be avoided and there should be no vexatious interference with the study of natural history.

After sketching the history of the law relating to wild birds the Report proceeds to consider the protection afforded by existing laws. The fundamental provision of these laws consists in the setting up of a close time for all birds from the 1st March to the 1st August, subject to the right of an owner or occupier of land or persons authorised by him to destroy on such land any birds *except* those mentioned in a Schedule. It is pointed out that this Schedule is very imperfect—many rare or harmless birds being omitted—as for instance the Robin, Swallow, Martin and most of the warblers, all birds beneficial to agriculture.

In addition to this fundamental provision, the existing laws enable the Secretary of State, on application by a county or borough council, to vary the close time, to add or to remove from the Schedule any species of bird, and to protect particular species for periods of the year outside the close time or to protect all birds in particular places.

The Report then goes on to consider in detail the existing Acts and the Orders made under them, and points out that the interpretation of the Acts is uncertain and that the Orders are difficult to understand. Moreover, the latter are often made without expert assistance, do not appear to be on any settled plan, and vary from county to county—even where the

* Cmd. 295, 1919, price 6d. net. Published by H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2.

agricultural and other conditions affecting bird life are similar. The section on the law in England and Wales concludes with the statement that "as long as the law remains as varied and as difficult to understand as at present, it can hardly be expected to secure any satisfactory degree of observance."

Following the above section are chapters which discuss the questions of offences and penalties and the administration and enforcement of the Acts. These matters give rise to several criticisms, and, finally summing up the results of the existing law (Chapter V.), it is stated that there is no doubt that 50 years of wild bird protection have resulted in a considerable increase in the bird life of the country, but "if the law has operated to protect common birds, it has been largely ineffective in protecting rare birds and their eggs." It was evidently the unanimous opinion of the Committee, as it must be of all who have given attention to the subject, that it is full time for the introduction of a new Act for the protection of wild birds.

The Committee, therefore, considered new legislation, the possible lines of action being (a) to protect only birds which are scheduled, species not named in the Schedule being unprotected, and (b) to protect all birds except certain species named in a black list. The latter proposal, though attractive, was rejected as being impracticable, and new legislation, based on the former alternative, is proposed. The principles of this legislation are as follow :—

1. The protection of all birds during the breeding season (1st March—1st September) subject to the right of the owner or occupier, or persons authorised by him, to take on his land any birds not mentioned in Schedules A or B.

2. Birds mentioned in Schedule A to be absolutely protected during the breeding season.

3. Birds mentioned in Schedule B to be absolutely protected all the year round.

It is also suggested that the central authority should have power, on application by a local authority, to vary the close time, to add to or subtract from the Schedules, to exempt destructive birds from all protection, and to protect all birds, with specified exceptions, throughout definite local areas.

Eggs and nests are included in the above proposals, those of all birds mentioned in either Schedule being protected. Special suggestions are, however, made with regard to the eggs of the Lapwing (Plovers' eggs) which may be taken by owners (or persons authorised by them) up to the 15th April, and those of the Woodcock, to be protected from 1st February to 1st August.

Lists of birds to be included in the Schedules A and B are given, but as they are only tentative it is not necessary to quote them in full. The only common farm birds mentioned in Schedule B (absolutely protected), are the Tawny and Barn Owls, while in Schedule A (those protected during the breeding season) the only bird which in England may occasionally be harmful is the Kestrel. The local option for excluding such birds from protection when they become too numerous should, however, safeguard the poultry keeper and game preserver against "rogue" Kestrels, which develop a liking for young chickens and pheasants. Bad habits of this kind are seldom developed in Kestrels, except when they have become numerous and are hard put to find sufficient food to feed their young.

From the sporting point of view the exercise of the local option is evidently anticipated in the case of certain protected species, such as Mallard (Wild Duck), which may, with advantage, be shot before 1st September in some marshland districts.

Up to this point the proposed new Act follows in principle the old Act with such improvements—as for instance Schedule B—as practical experience has dictated, but there are one or two other important suggestions deserving mention.

1. An Ornithological Advisory Committee is proposed, which shall advise the Central Authority on all questions and shall be in charge of investigations into the bird life of the country. Provision is specially suggested for the representation of agriculturists on the proposed Committee, which should ultimately be in a position to pronounce a verdict on many of the vexed questions relating to birds harmful to agriculture.

2. It is proposed to give the central authority power to group together counties similar in their bird life, and, so far as amendments to the Schedules are concerned, to deal with these groups as a whole. This would reduce the number of cases in which a bird is protected in one parish and may be shot in the next—usually an incomprehensible state of affairs.

3. It is proposed that birds, their nests and eggs should be absolutely protected on Sundays throughout the year.

4. Licences should be issued enabling owners and occupiers to shoot harmful birds, provided that such birds may not be sold. Licences should also be available for shooting birds for scientific purposes.

5. The killing or taking of wild birds by aircraft or mechanically propelled boats should be prohibited.

6. Various provisions are suggested whereby it will be illegal to have or sell any bird which has been illegally taken, and these provisions apply to skins, plumage or eggs, which are liable to forfeit, as also are guns or other instruments used in the committing of the offence. These provisions should do much to suppress the nefarious traffic in rare birds' skins and eggs.

Other provisions deal with the unauthorised liberation of foreign birds in Britain, the killing of birds around the coast, international action for the protection of birds, etc., but enough has probably been said to indicate the wide scope of the Report and the thorough examination which the subject has received. An enlightened system of bird protection cannot be other than beneficial to agriculture, and it is to be hoped a new Act based on this Report will shortly be passed.

In a report issued by the East Suffolk County Education Committee an account is given of certain field experiments conducted in East Suffolk, during the past few years, to test varieties of wheat.

Wheat Variety Trials.

It was found that in 1912 Wilhelmina gave the best yield, followed by Victor, Square Head's Master, Standard Red and Little Joss, in order of yield. The results obtained during the years 1913-1917 are summarised in the following table* :—

Variety of Wheat.	1913.	1914.	1915.	1916.	1917.
	<i>Bush.</i>	<i>Bush.</i>	<i>Bush.</i>	<i>Bush.</i>	<i>Bush.</i>
Victor	—	46	41	—	—
Brooker's Double Standup ..	41	47	41	38	36
Little Joss	41	45½†	41	—	37
Wilhelmina	38	—	40½	—	—
Swedish Square Head II. ..	—	43½	39	33	—
Square Head's Master	38	39½	38½	—	—
Swedish Grenadier III. ..	—	—	38	—	—
Swedish Iron	—	—	—	39	37
Benefactor	—	—	—	34	—
Browick	—	—	—	28	—
Wilson's Selected	—	—	—	33	—
Raynham's Challenge	—	—	—	32	—
Fenman	—	—	—	—	41
Salmon	—	—	—	—	34

When the results of the whole series of years are considered it is found that Brooker's Double Standup, Swedish Iron,

* In 1914 Swedish Iron was tested at one centre, where it gave a bush 4 st. more per acre than Brooker's Double Standup.

In 1915 several varieties were tested at another centre as well, but in two fields. Of these varieties Brooker's Double Standup and Swedish Iron gave the best crop, being about equal in yield. Victor gave a good yield, but was tested in one field only.

† Two centres only.

Victor, Wilhelmina and Little Joss have all given excellent results. Fenman has been tried for only one year. It is very short in the straw and seems a useful wheat for good land. Brooker's Double Standup is a white wheat, which has repeatedly given the highest yields in the tests. It is an excellent all-round wheat, being suited for all classes of land. Victor and Wilhelmina are very similar in type, but apparently slightly inferior in yield.

Swedish Iron is a stiff-strawed, large-grained wheat, suited for good land in a high state of cultivation. Under such conditions it gives very heavy yields; the heaviest yield ever obtained in the Education Committee's tests was given by this variety.

Little Joss is an excellent all-round wheat introduced by Professor Biffen. It is a red variety of good quality, and has much to recommend it.

Swedish Extra Square Head II. is very stiff-strawed, and is especially suited for very rich land. On poorer land it is probably inferior in yield to some of the other varieties tested, and is very subject to rust.

SPECIMENS of young onions and carrots attacked by a species of dodder have been submitted to the Board by Mr. A. A.

Dodder on Onions and Carrots. Pettigrew, Chief Officer, Parks Department, Cardiff. The presence of dodder was reported from 10 separate allotments in

the Cardiff district, and though onions were chiefly attacked, the pest was also found on carrots, parsnips, turnips, birds' foot trefoil, sandwort, white clover, wild parsnip, and several grasses.

A flowering specimen of the dodder was examined at the Royal Botanic Gardens, Kew, and proved to be *Cuscuta suaveolens*, Ser. (also known as *C. racemosa*, Mart., and as *C. chiliana*, Engelm.), a native of Chile, but frequently recorded as an alien in various parts of Europe and America outside Chile. It is clearly allied to *Cuscuta Gronovii*, the common American dodder, which seems indifferent as to its hosts, and will attack anything from a tall aster to an onion, or even shrubby plants, such as willows. The stems vary from a deep yellow to an orange colour. The flowers are very numerous, in dense clusters, and have waxen white corollas with rounded lobes. The seeds are large for the genus. *C. Gronovii* has not been recorded wild in this country, but is sometimes cultivated in botanic gardens. At Kew it used



FIG. 2.—Carrots attacked by Dodder.

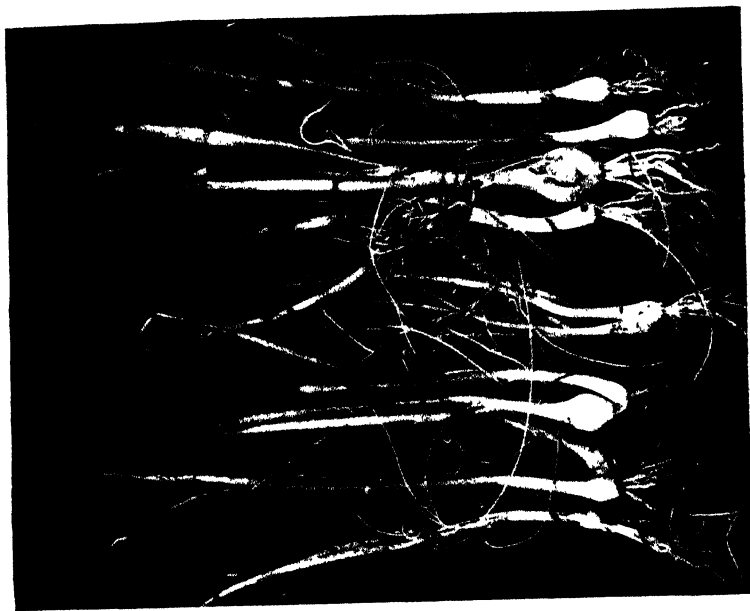


FIG. 1.—Onions attacked by Dodder.

to occur on asters in the herbaceous ground, where, for several years at least, it seeded and reproduced itself.

The Board considered it possible that *C. suaveolens* had been introduced with American onion seed. An effort was accordingly made to trace the sources from which the Cardiff allotment holders had acquired their onion seed. Only one sample could, however, be obtained with certainty, and this proved on examination at the Seed Testing Station not to contain dodder. It seems likely, therefore, that the dodder must have been introduced into the land in red clover seed or clover seed from Chile some time previously in the rotation.* (See also this *Journal*, August, 1916, p. 504; December, 1912, p. 762; June, 1909, p. 209, and Leaflet No. 180, issued by the Board.)

THE *Guide to Experiments* at the Cockle Park Experiment Station, 1919 (Bulletin No. 29), contains an account of some experiments on methods of extermination of yellow rattle. This weed was very prevalent on some of the meadow hay

plots in Palace Leas field, and it was decided in 1916 to mow early, before the seeds of the weed had become ripe. The early mowing was done in the third week of June. In 1917 the following plots were laid down. The plots ran north and south, were each 15 ft. wide, and were arranged as follows:—

Plot 1 (to east)	—3 cwt. common salt, applied 21st April.
„ 2 „	—6 cwt. common salt, applied 21st April,
„ 3 „	—3 cwt. common salt, applied 5th May.
„ 4 „	—6 cwt. common salt, applied 5th May.
„ 5 „	—Untreated.

Owing to the very late spring it was found necessary to delay the applications till the above dates, when the young yellow rattle plants were beginning to make some growth.

When the plots were closely examined on 5th May, 1917, on the part mown early in the previous year, no yellow rattle was found, while on the remainder of the plots there was an abundance of young yellow rattle plants.

The salt dressings checked the yellow rattle very slightly; in fact they more seriously reduced the grasses, and especially the clovers. The salt had the most injurious effect when frosty mornings and bright sunshine quickly followed the April dressings.

It was evident in 1917 that the crops of hay on the plots were considerably heavier after early mowing in 1916, probably

* Since this note was written two samples of carrot seed actually containing seeds of Chilian dodder have been received at the Seed Testing Station. It is believed that these samples are of French origin.

to the extent of over 5 cwt. an acre. Early mowing was again practised in 1917, with the result that the yellow rattle plants have now disappeared from this field. The results of this trial are most important, as this noxious plant does enormous harm in old hay land. It is thus shown that early mowing before the seeds are formed will get rid of the weed. Grazing the meadows for one or two years will give the same result. (See also this *Journal*, March, 1913, p. 1005, and Leaflet No. 251, issued by the Board.)

A ROYAL DECREE has recently been made by the Italian Government to provide for the necessity of increased agricultural production, with special reference to cereals, vegetables, and edible tubers. It had been felt in many quarters in the country that proper use was not being made of large tracts of land which had never been placed under cultivation, owing to the difficulties raised by the landowners in granting leases on adequate terms and to the indisposition of landowners or the State to sink any capital for the development of such land. Expression to the prevalent feeling of dissatisfaction was shown on the 24th August by the organised seizure by a number of farmers of tracts of uncultivated land in 200 localities in the vicinity of Rome, chiefly at the instigation of the "League of Fighting Soldiers."

It was to deal with the situation thus created that the Royal Decree was issued. Under the Decree farmers belonging to legally constituted agrarian associations are secured in temporary occupation of land concerning which questions of civil custom have arisen, for a period of four years. The landowner is to receive fair compensation, and when this cannot be decided by common agreement the matter will be determined by an arbitration committee. There is a right of appeal against a decision by this committee. Under certain provisos framed in the best interests of land cultivation application may be made before the termination of the provisional occupation for the occupation to be made permanent.

The Decree also provides for the granting of State assistance where it is considered desirable, empowers agrarian societies to collect from their members payments due in respect of incoming subscriptions, repayments, etc., on the principle of the collection of direct taxes, and makes the Minister of Agriculture responsible for the supervision of agrarian associations and bodies.

Barley.—In reply to Mr. Ramsden, respecting the resumption of the control of the price of barley, in order to discourage farmers from sowing barley in preference to wheat, the Parliamentary Secretary to the Board stated that the information at the disposal of the Board lends no support to the suggestion that farmers are reducing the area sown with wheat in order to sow barley in its place. The fact that particular samples of malting barley have this season risen to a high price, in comparison with the artificially reduced price of wheat under control, had no bearing upon the relative prices that may prevail next season. The Board did not propose to advise the Ministry of Food to resume control of the current crop of barley, a large proportion of which has already been sold. (28th October, 1919.)

Oats.—In reply to Mr. Sturrock, respecting the desirability of controlling oats at a moderate price, the Food Controller stated that the price of oats had fallen since the harvest, and a further fall was expected as the crop moves more freely and the larger supply of imported oats and maize, coming forward, became more generally felt. In the circumstances, he was in agreement with the President of the Board of Agriculture that action in the matter was not required at the present moment. The situation, however, was being carefully watched. (29th October, 1919.)

Question of Payment to Corn-growers.—The Parliamentary Secretary to the Board, in reply to a question by Mr. A. Henderson as to payment, corn-growers, stated that nothing had been paid under the State guarantee, nor was any payment due at the present time. Whether any sum would fall to be paid in respect of the current year's crop would depend upon the average *Gazette* prices for the seven months ending March next. *Gazette* prices for wheat, barley and oats were at present far above the guarantee, and it was very improbable that any payment to growers would have to be made. (29th October, 1919.)

Flax.—In answer to a question by Mr. Stewart, the Parliamentary Secretary to the Board stated that the Flax Production Scheme of the Board was initiated during the War with the primary object of increasing the home production of flax. Flax production was a most important industry, for flax products were the essential material in the manufacture of aeroplane wings, and were required for many other purposes of vital importance to the nation, both in war and in peace. Before the War between 70 per cent. and 80 per cent. of the flax required in the United Kingdom came from Russia. The supply from this source having been much reduced, there was a very serious shortage of raw material, both at the present time and in prospect, for the spinners in the United Kingdom. A secondary object of the scheme was to develop experiments begun before the War with great promise of success, with a view to the re-establishment of the flax industry in the rural economy of Great Britain. The financial position, in round figures, was as follows :—

Capital expenditure on land, buildings, and factory equipment	£ 750,000
Other expenditure to date, including cost of propaganda, the training of workers, and experiments ..	850,000

Estimated further expenditure to complete scutching	£
of 1918 and 1919 crops	900,000
Revenue to date	300,000
Estimated further revenue from stocks in hand ..	1,300,000

The Board were now considering offers for the purchase of the whole undertaking, and were confident that under sound commercial management the industry had every prospect of success now that the initial difficulties of starting a new industry were overcome. (29th October, 1919.)

Apples.—In reply to Colonel Yate, the Parliamentary Secretary to the Board stated that the Board were endeavouring to stimulate commercial apple-growing on land suited for the purpose in connection with their general programme for developing horticulture, and that they were being assisted in their efforts by horticultural committees, which were being established in each county under the local authority responsible for agricultural education. The chief difficulty in connection with promoting the growth of apples was that the supply of trees for planting was likely to be very limited for the next three or four years, but the Board had arranged with the Wye College Fruit Experiment Station and the Agricultural and Horticultural Research Station, Long Ashton, for large supplies of stocks to be raised for distribution amongst nurserymen and others, so that by rapid propagation a certain and large supply might be assured in a few years' time. The Board proposed to circularise railway companies in due course, asking them to consider the question of planting fruit trees, but it would be inadvisable to do this until such time as stocks were adequate and the needs of the commercial growers and small holders on land settlements had been satisfied. (30th October, 1919.)

Ploughing Scheme.—Replying to Major Sir B. Falle, the Parliamentary Secretary to the Board stated that the ploughing scheme of the Food Production Department was started in the early months of 1917, and resulted in a total increase in the tillage area of nearly $1\frac{1}{2}$ million acres. Following on the Armistice it was decided that the scheme, so far as the use of Government tractors was concerned, should be brought to an end as soon as possible after the conclusion of the spring ploughing, and the Tractor Organisation had been in process of liquidation since May last. To avoid hardship to individual farmers who had entered into contracts with the Board, a small proportion of the tractors was retained at work until the end of September, when operations ceased. So far as the objects of the Tractor Organisation were to get the land cultivated and to produce food it was a great success, but it was necessarily run at a loss, as already explained in the White Paper (Cmd. 304) issued in August last. The machinery and implements employed were being disposed of by the Board of Agriculture in conjunction with the Disposal Board. Already the greater part had been sold at favourable prices, and the money so received must be set off against the cost of the scheme. The staff had also been discharged, with the exception of a small number engaged in the work of disposal and clearing up. (30th October, 1919.)

Agricultural Organisation Society.—The Parliamentary Secretary to the Board of Agriculture, in reply to a question of Mr. A. Henderson, stated that grants to the Agricultural Organisation Society have been

made from public funds every year since and including the year 1909. In 1918 the following grants were made to the Society: £7,000 from the Food Production Department funds for organising co-operation among allotment holders, £4,000 from the small holdings account for organising co-operation amongst small holders and allotment holders, and £18,794 from the Development Fund for the general work of organising co-operation amongst farmers. In addition, the Board repaid expenses incurred by the Society to the amount of £1,683, in the special work of organising co-operative milk depots, which was undertaken by the Society at the Board's request. (30th October, 1919.)

OFFICIAL NOTICES AND CIRCULARS.

N.B.—The Orders mentioned in this section of the JOURNAL may usually be obtained at the price of 1d. each from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, and 28, Abingdon Street, London, S.W. 1; 37, Peter Street, Manchester, and 1, St. Andrew's Crescent, Cardiff.

In view of the continued increase in the spread of Wart Disease and the consequent menace to the potato crop of this country, the Board have made a new Order for the control of Wart Disease, the main provisions of which are stated below.

Wart Disease of Potatoes Order, 1919.

The principal change in procedure is in respect of the sale of potatoes for planting, and their introduction into infected areas. Under the Wart Disease of Potatoes Order of 1918,* which is revoked by the new Order, no potatoes of approved immune varieties were permitted to be sold for planting, except under the authority of a licence granted by the Board. This restriction is now removed, but in order to ensure that only pure stocks of approved immune varieties of potatoes are planted in infected areas, provision has been made in Article 4 of the new Order to control the introduction of potatoes into infected areas.

Except as above mentioned the new Order follows closely the Order of 1918.

The following are the main provisions of the Order :

1. The Order applies to all areas which the Board have certified to be infected areas, and to all lands to which the provisions as to infected areas have been applied, under the Wart Disease of Potatoes Order of 1918.

2. Every outbreak of Wart Disease must be reported immediately to the Board or to an Inspector of the Board by any person in charge of potatoes affected by the disease or of land on which the disease exists.

3. Only those varieties of potatoes approved by the Board as immune from Wart Disease may be planted in land to which the Order applies, except that in 1920 only an Inspector of the Board may authorise by licence the planting of specified first early non-immune varieties under certain conditions.

4. Potatoes of approved immune varieties which were inspected whilst growing and certified by the Board of Agriculture and

Fisheries, by the Board of Agriculture for Scotland, or by the Department of Agriculture and Technical Instruction for Ireland, may be introduced into an infected area without licence, but on the occasion of a sale of such potatoes for planting the seller must furnish the buyer with a declaration, preferably in the invoice, correctly stating the serial number of the relative certificate. No other potatoes for planting may be brought into an infected area except under licence from the Board.

5. Potatoes grown in any infected area or in land to which the provisions of the Order as to infected areas have been applied, must not be sold for planting in land which is not in an infected area or to which the Order does not apply.

6. Potatoes visibly affected with Wart Disease must not be sold or offered for sale for any purpose.

7. An offence against the Order is punishable by a fine of £10.

Copies of the Order, and any information respecting it, may be obtained free and post free on application to the Board of Agriculture and Fisheries, 72, Victoria Street, London, S.W. 1.

THE station at Ormskirk affords an interesting example of what may be done by co-operation between farmers on the one hand and the Board on the other. This co-operation **Ormskirk Potato Trials**, consists in the establishment at Ormskirk, largely through the initiative of Lancashire growers, of a station in which all commercial varieties, and all new varieties of potatoes are tested for their immunity from Wart Disease. The trials have now been conducted for several years and have shown that there are many good varieties of potatoes which may be grown with immunity in infected areas.

In spite of all steps taken to control Wart Disease, it is spreading gradually to other parts of the country. The knowledge gained as the result of the Ormskirk trials is becoming of increasing importance to potato growers throughout this country, and indeed throughout the world.

For the trials which were carried out at Ormskirk during the present year some 800 plots are in use, on which all the varieties obtainable have been grown.

It is, of course, not enough to find a potato which resists Wart Disease, but it is also necessary to discover one which crops well and is of good quality. These requirements are kept in mind in the Ormskirk trials.

THE Board have issued a new Order dealing with American Gooseberry Mildew. This cancels all previous Orders (except the American Gooseberry Mildew Fruit Orders of 1913 and **American Gooseberry** 1919), and alters considerably the previous Mildew. restrictions relating to the movement of gooseberry and currant bushes in certain areas.

Under the new Order the sale and movement of bushes *visibly affected* with the disease is prohibited absolutely, and persons growing bushes for sale must take responsibility for seeing that the pruning of the

bushes is performed in an efficient manner. At the same time all outbreaks of disease on bushes grown for sale must be reported to the Board.

Where fruit growers and private owners are concerned, the Board have power under the new Order to deal with those who fail to take proper steps to check the disease on land under their control.

During the period of the War the Board, although prohibiting the sale of mildewed berries, allowed such berries to be sent direct to jam factories. This policy is now embodied in the new Order.

THE following Circular Letter (No. 198/L. 6) was addressed to Agricultural Executive Committees by the Board on 9th October :—

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to say that he understands that difficulty is being experienced by many Agricultural Executive Committees in obtaining suitable land for the establishment of training centres for the training of disabled men in agriculture, and that on this account there is delay in arranging for the training of a number of disabled men who are eligible for such training.

According to information received by the Board from Agricultural Executive Committees, nearly 1,000 disabled men are at present awaiting training in agriculture, and while the majority of these will be provided for, it is clear that further provision must be made immediately for training the remainder. While it is impossible to say with any degree of certainty what will be the total number of disabled men who will require agricultural training, it is anticipated that between 5,000 and 6,000 men in all may have to be provided for in the immediate future.

This being the case, Lord Lee desires to press upon your Committee the need of proceeding at the earliest possible moment with the establishment of a training centre in the County if they consider one to be necessary, but in this connection your Committee should consult with the Committees of neighbouring counties as to whether one or more centres could not be used for a group of counties. Lord Lee would be glad if your Committee would in any event inform the Board before the 31st instant what action they are taking in this matter.

It is not necessary that land should be *purchased* for the establishment of training centres, but if there is difficulty in setting up centres in the manner suggested in paragraph 7 of the Board's Circular Letter of the 31st July (C.L. 188/L. 6),* Agricultural Executive Committees may probably be able to obtain by agreement from County Councils suitable land for use as training centres, which the Councils are unable to utilise immediately for small holdings. The Board authorise Agricultural Executive Committees to enter into agreements of this kind for a period of three years, but no such agreement should be made, or training centre established by an Agricultural Executive Committee, without the Board's previous consent, in each individual case.

* Not printed in this *Journal*.

I am to enclose* for the information of your Committee a copy of a Circular Letter which has been addressed by Lord Lee to County Councils, inviting their co-operation in this matter.

I am, etc.,

(Signed) A. D. HALL,

Secretary.

ENCLOSURE.

Circular Letter (No. 199/L.6), dated 9th October, 1919, addressed to County Councils by the Board.

SIR,—Your Council is doubtless aware that the Board of Agriculture and Fisheries have been charged with the responsibility of providing training for disabled ex-service men who, desirous of taking up an agricultural occupation, do not possess the necessary practical experience. The local administration of this scheme is being undertaken by the County Agricultural Executive Committees. These Committees find, however, that in certain cases their work is hampered owing to the difficulty of securing suitable land as training centres. At the same time the Board are not prepared to authorise Executive Committees to purchase land for this purpose, as the scheme is, naturally, only a temporary one.

The President hopes that it may be possible for County Councils to assist the Board in this respect by placing at their disposal farms or parts of farms acquired under the Land Settlement Scheme, but which it is not possible to let immediately as small holdings owing to the difficulty of providing equipment. Lord Lee, therefore, desires that each County Council should consider sympathetically any applications which they may receive from their Agricultural Executive Committee for assistance in this respect. In the event of a County Council finding itself in a position to comply with an Executive Committee's request, an agreement should be entered into, letting the land to the Committee and charging them with a fair rent.

It may be useful for the County Councils to know the main features of the training scheme. Disabled men are provided with courses of instruction of twelve months' duration. The training scheme is expected to last for at least three years. The largest proportion of applications are received in most counties from men who desire training, not in farming proper, but in the lighter forms of cultivation, such as market gardening, fruit-growing and poultry keeping.

Executive Committees are authorised to take land on agreement for a period of three years, and arrangements will be made for housing men undergoing training, either by means of army huts or other temporary accommodation.

The Board are forwarding a copy of this letter to each Agricultural Executive Committee and suggesting to them that they should place themselves in communication with the County Council whenever they experience difficulty in obtaining the use of suitable land for training purposes

I am, etc.,

(Signed) A. D. HALL,

Secretary.

THE following Circular Letter (No. 232/L. 6) was addressed to County Councils and Councils of County Boroughs in England and Wales by the Board on 25th October :—

Land Settlement: SIR.—I am directed by the President of
Compulsory Hiring. the Board of Agriculture and Fisheries to refer to the Board's Circular Letter of the 26th August last (C. L. 197/c 6),* in which the advantages of compulsory hiring and the procedure to be adopted for that purpose were explained.

The recommendation of compulsory hiring was therein based on the possible risk of a fall in the value of land, but an even more important consideration in this connection is the imperative necessity of reducing as far as possible the expenditure of State funds at the present time.

The Land Settlement (Facilities) Act provides for a sum of twenty millions to be available for loans to County Councils within the next two years, of which not more than £17,250,000 will be available for England and Wales.

It is clear that even if the Treasury are prepared to issue the whole of this authorised amount, it may prove insufficient to supply the requirements of the applicants, which the Government are pledged to satisfy, if a large part of the land is purchased for cash.

The cost of equipment must be paid in cash, and it is therefore essential that as large an amount as possible shall be reserved for this purpose.

There are two alternatives to purchase for cash :—

- (1) Hiring land ; and
- (2) Purchase for county annuities.

The Board recognise that where a landowner desires to realise the value of his estate his ability to do so is not improved by his land being acquired on lease under the provisions of the Act of 1908, but this should not be the case if his land is bought for county annuities. These will be payable so far as funds permit out of the revenue from the 'mall holdings, but they will also be secured by a charge on the county rates, and should be readily saleable, particularly if the amounts issued are sufficiently large to create a market for such securities.

The Board think that before compulsory hiring is resorted to, a Council should offer to buy the land for county annuities, and that if such offers are refused no reasonable objection can be raised to the use on an extensive scale of the compulsory hiring powers.

As was explained in the Circular Letter referred to above, land may be hired compulsorily for a period of 35 years, and at the end of that period the tenancy is renewable for a further period. It is possible, therefore, to obtain what is in effect a perpetual lease, subject only to the right of the landlord with the sanction of the Board to resume possession for building or industrial purposes. In the case, however, of purely agricultural land, there is very little likelihood that a landlord will be in a position to exercise his right of resumption.

The requirements of a considerable number of the applicants can be met by the provision of land alone without the necessity of having to erect new buildings, and in such cases there is no reason from the point of view of the Council why the land should not be acquired on lease instead of by purchase. Even in those cases where new equipment

is required Councils might merely purchase a small area of land on which the houses and buildings could be erected and obtain the remainder of the land required for the settlers on lease. If this course is adopted it would minimise the danger of the Council incurring loss, even if the landlord established his right to resume possession of the land leased.

I am to suggest, therefore, that Councils should not confine themselves to considering land which is in the market for sale, but that they should make up their minds as to the land they require for settlement purposes, and that, having selected the land, they should proceed to acquire it by adopting the procedure indicated above, only purchasing for cash any area which is required for buildings.

The Board are advised that the fact that an owner may be willing to sell his land for cash is no bar to the exercise by the Council of their powers of compulsory hiring if they are of opinion that on grounds of public policy hiring is preferable to purchase.

I am, etc.,

(Signed)

A. D. HALL,

Secretary.

The following is a PRELIMINARY STATEMENT showing the ESTIMATED TOTAL PRODUCTION OF HOPS in the Years 1919 and 1918, with the ACREAGE AND ESTIMATED AVERAGE YIELD

Produce of Hops. per STATUTE ACRE in each COUNTY OF ENGLAND in which Hops were grown. It is

dated 27th October, 1919 :—

COUNTIES, &c.			Estimated Total Produce.		Acreage Returned on 4th June.		Estimated Average Yield per Acre.	
			1919.	1918.	1919.	1918.	1919.	1918.
KENT	East ..	..	Cwt. 28,000	Cwt. 23,000	Acres. 2,529	Acres. 2,371	Cwt. 11.1	Cwt. 9.8
	Mid ..	..	45,000	35,000	3,652	3,336	12.3	10.4
	Weald ..	..	52,000	35,000	4,378	4,032	12.9	8.6
	Total, Kent		125,000	93,000	10,559	9,739	11.9	9.5
HANTS	..	..	7,000	6,000	757	717	9.2	8.3
HEREFORD	..	..	28,000	14,000	2,415	2,331	11.6	6.1
SALOP	..	..	470	380	47	48	10.0	8.0
SURREY	..	..	1,500	960	180	193	8.3	5.0
SUSSEX	..	..	15,000	7,100	1,418	1,310	10.6	5.4
WORCESTER	..	..	17,000	8,700	1,372	1,328	12.4	6.5
TOTAL	..	..	194,000	130,000	18,748	15,666	11.6	8.3

NOTE.—The total production this year amounts to 194,000 cwt., or half as much again as that of last year, and rather less than seven-tenths of the average production of the last ten years, on an area which is somewhat larger (7 per cent.) than last year, but still less than half of the pre-war average. The yield per acre (11.6 cwt.), however, is heavier than last year by 3½ cwt., and 2 cwt. heavier than the average.

THE following is a PRELIMINARY STATEMENT showing the estimated total produce and yield per acre of the CORN, PULSE, AND HAY CROPS in England and Wales in the year 1919, with Agricultural Returns, comparisons for 1918, and the average yield per acre of the ten years 1909-1918. It is dated 11th November, 1919 :—

—	Crops.	Estimated Total Produce.		Acreage		Average Estimated Yield per acre.		Average of the Ten Years, 1909-1918.
		1919.	1918.	1919.	1918.	1919.	1918.	
ENGLAND AND WALES.		Quarters.	Quarters.	Acres.	Acres.	Bush.	Bush.	Bush.
	Wheat ..	7,979,000	10,330,000	2,220,921	2,556,661	28.7	32.9	31.1
	Barley ..	5,478,000	6,080,000	1,509,588	1,500,809	29.0	32.4	31.9
	Oats ..	11,383,000	14,339,000	2,563,628	2,780,061	35.5	41.3	39.4
	Mixed Corn	822,000	620,000	142,423	139,077	24.9	35.7	—
	Beans ..	854,000	889,000	273,841	242,007	24.9	29.4	27.6
	Peas ..	441,000	439,000	132,212	127,857	26.7	27.5	24.8
	*Seeds Hay	1,770,000	2,093,000	1,590,933	1,446,504	22.6	29.0	28.9
ENGLAND	†Meadow Hay	3,425,000	4,638,000	4,170,616	4,298,498	16.4	21.5	22.3
		Quarters.	Quarters.	Acres.	Acres.	Bush.	Bush.	Bush.
	Wheat ..	7,732,000	10,174,000	2,150,078	2,460,695	28.8	33.1	31.2
	Barley ..	5,076,000	5,666,000	1,406,507	1,394,861	28.9	32.5	32.0
	Oats ..	10,024,000	12,661,000	2,281,257	2,414,559	35.8	41.0	39.9
	Mixed Corn	512,000	507,000	115,641	111,726	36.4	36.3	—
	Beans ..	846,000	879,000	271,332	239,429	24.9	29.4	27.6
	Peas ..	440,000	437,000	131,680	127,147	26.7	27.5	24.8
WALES.		Tons.	Tons.			Cwt.	Cwt.	Cwt.
	Seeds Hay	1,602,000	1,918,000	1,321,936	1,301,694	23.9	29.5	29.3
	†Meadow Hay	3,039,000	4,222,000	3,634,744	3,812,485	16.5	22.1	22.6
		Quarters.	Quarters.			Bush.	Bush.	Bush.
	Wheat ..	247,000	356,000	70,843	95,966	27.9	29.7	27.8
	Barley ..	400,000	414,000	104,051	105,048	30.7	31.4	30.6
	Oats ..	1,359,000	1,678,000	312,371	395,502	34.8	35.7	35.2
	Mixed Corn	111,000	113,000	26,782	27,351	33.2	31.2	—
		Tons.	Tons.			Cwt.	Cwt.	Cwt.
	Beans ..	7,900	9,700	2,450	2,668	25.4	29.1	27.4
	Peas ..	1,400	1,900	632	710	21.1	21.6	22.4
	Seeds Hay	168,000	180,000	153,907	144,810	21.1	24.9	25.4
	†Meadow Hay	328,000	466,000	475,872	483,013	16.2	19.2	19.8

* Hay from Clover, Sainfoin, and Grasses under rotation.

† Hay from Permanent Grass.

NOTE.—The yield of wheat is estimated at 28½ bush. per acre, which is 4½ bush. less than last year, and 2½ bush. below the average of the ten years 1909-18. The total production, from a smaller area, amounts to 7,979,000 qr. Although this is fully 2½ million less than last year (the highest on record) and about half a million qr. less than in 1915, this is apart from these two years, the highest since 1898 and nearly half a million qr. above the average of the last ten years. Barley has yielded 29 bush. per acre, or 3½ bush. less than in 1918 and nearly three bush. below average. The total production is 5,476,000 qr. or 600,000 qr. less than in 1918, and 310,000 qr. below the average; with the exception of 1915 and 1916, this is the smallest crop since official estimates were first collected in 1885. The production of oats, although nearly 3,000,000 qr. less than in 1918 (the highest on record) is, except for that year, the highest since 1907; but the yield per acre is nearly six bush. less than in 1918, and nearly 4 bush. less than the average. Mixed or dredge corn, distinguished for the first time last year, shows a slightly increased total production, but the yield per acre is somewhat less. Beans have yielded 2½ bush. to the acre less than the average and 4½ bush. less than last year and, although the area was increased this year, the production is 35,000 qr. less. Peas yielded nearly two bush. per acre above average. The hay crops were very light: the total production, 5,195,000 tons being the smallest since 1893, and only about three-quarters of last year's crop, and two-thirds of the average of the last ten years. Seeds' hay (clover, sainfoin, and grasses under rotation), from an area larger by about 55,000 acres, yielded nearly 330,000 tons less

than in 1918, the yield per acre (23½ cwt.) being more than 5 cwt. less than in 1918 and than the average; it is the lowest since 1896. The yield per acre of meadow hay (16½ cwt.) is also more than 5 cwt. less than in 1918 and is the lowest since 1901; it is nearly 6 cwt. below the average. The estimate of the hop crop was issued on the 27th ult.; the returns of the production of potatoes and roots are collected at a later date, and will be issued subsequently.

THE Village Clubs Association reports that applications for affiliation are now being received almost daily, but that only those clubs can be accepted whose rules are in accordance with the general principles of the Association. These principles cannot be too widely known. They are:—

1. That the Club should be the centre of all social activities and of all forms of physical and mental recreation;
2. That it should be self-supporting and free from the element of patronage;
3. That all inhabitants of the village, without distinction of class or opinion, should be eligible for membership;
4. That the entire control should be vested in a committee elected either by (a) the members, or (b) the members and all the residents of the parish and those within a radius of three miles who would be eligible for membership.

In order to improve the breeds of cattle the Belgian Government has passed an Act, which provides for the formation of associations of farmers who will carry out an educational campaign among Belgian stock breeders.

Steps to Improve Cattle Breeds.

It is felt that neither the native-produced forage nor the imported feeding stuffs are utilised to the best advantage, and that the only remedy is to give public authorities the power and the means to instruct cattle raisers in better methods, so as to produce purer species and better varieties of beasts adapted to the many needs of the country. It is also felt that knowledge of cross-breeding is capable of improvement, and the great majority of breeders, too, do not possess sufficiently large herds to enable them to exercise the best choice in the selection of animals for reproductive purposes.

With these objects in view the Belgian Government has passed a Decree that a special "Comité Technique de l'Elevage" be attached to the Administration of Agriculture to study cattle-breeding problems. In addition, an "Institut Spécial de Zootechnie" is to make researches and experiments in the reproduction of animals of suitable character, and Associations d'Elevage, having for their purpose the raising of improved breeds of cattle, are to be formed and supported by subsidies from the Government. (*Board of Trade Journal*, 30th October, 1919.)

No further cases of Foot-and-Mouth Disease having occurred in that part of Warwickshire which was placed under restrictions on account of the case at Kingsbury, or in Dorsetshire, the restrictions in those districts were withdrawn on 31st October.

Foot-and-Mouth Disease.

Outbreaks of Foot-and-Mouth Disease have been confirmed in five separate districts (see below), and in each case an Order was issued prohibiting movement of animals in a wide area surrounding the infected place. Slight modifications of the Orders have been made in the outer portions of the areas, except in the case of the Surrey area, to facilitate the movement of animals for slaughter. The origin of these outbreaks has not yet been traced.

1. *Warwickshire*.—The initial outbreak, on premises near Rugby, was confirmed on 17th October.* One further outbreak in vicinity was confirmed on 24th October.
2. *Huntingdonshire and District*.—The initial outbreak, on premises at Great Gransden, was confirmed on 20th October. Five further outbreaks, the last on 1st November, have been confirmed in the vicinity of the original case.
3. *Isle of Wight*.—Two initial outbreaks, on premises at Northwood, near Cowes, were confirmed on 21st October. Twenty-four further outbreaks have been confirmed in the island, the last case being on 10th November.
4. *Lincolnshire*. The initial outbreak, on premises at Horsington, near Horncastle, was confirmed on 29th October. Five further outbreaks, the last being on 6th November, have since been confirmed.
5. *Surrey*.—An outbreak was confirmed at Hindhead on 12th November.

The Board have, however, been able to modify in each of the scheduled districts the restrictions at first imposed.

THE total number of outbreaks of Rabies confirmed is now 249, namely, 102 in Devon, 27 in Cornwall, 78 in Glamorgan, 12 in Monmouth, 2 in Gloucester, 7 in Middlesex, 11 in Surrey, 1 in London, 2 in Kent, 1 in Berkshire, 1 in Brecknock, and 5 in Essex.

Rabies.

The restrictions in the London area have been slightly modified, and parts of Essex, Middlesex, Hertfordshire, and Buckinghamshire, were withdrawn from the area.

ON 30th October, 1919, a very successful sale of recorded dairy cattle, the property of members of Oxon, Berks and Hants Milk-recording Societies, was held at Reading. 64 cows were sold, including one pedigree Shorthorn that fetched 78 guineas, two pedigree Lincoln Reds which made an average of 87 guineas, 5 Crossbreds and 56 non-pedigree Shorthorns. The principal

Sale of Recorded Dairy Cattle.

prices were 165 guineas, paid twice, one cow being purchased at that figure for H.M. The King. Next came 160, 110, 105, 105 and 100 guineas, these being all for non-pedigree Shorthorns. One Crossbred Shorthorn Holstein made 100 guineas. Eight of the cows sold are entered in Volume 2 of the Board's Register of Dairy Cows. These fetched an average of £109. Seven of them averaged over £121.

At the West of England Cattle Breeders' Association Sale, held at Yeovil on 4th November, a non-pedigree Shorthorn cow recorded with the Yeovil Milk-recording Society fetched the highest figure, viz., 140 guineas, and a heifer from her, born in 1918, sold for 100 guineas. Other recent successful dispersal sales of recorded herds are :—

Sale by Mr. Stanley Young, member of Yeovil Milk-recording Society.

„ Mr. S. Taylor, member of Cambridge Milk-recording Society.

„ Mr. James Lyon, member of Surrey Milk-recording Society.

At the latter sale 56 cows and heifers, including 27 heifers born in 1916 or later, averaged £68.

The results of these sales are evidence of the commercial value of milk records when taken and checked under the Board's scheme.

In view of the increased cost of production, the Board have reluctantly decided to raise the price of this *Journal* to 6d. per copy, commencing with the January issue.

**Increased Price of
"Journal."**

The rates of subscription in respect of orders or renewals received after the issue of the December number will, therefore, be as follows :—

	<i>United Kingdom and British Colonies (Post free).</i>	<i>Foreign Countries (Including postage).</i>
One year	6s.	8s.
Six months	3s.	4s.
Three months	1s. 6d.	2s.

Back numbers, where still available, may be obtained at 4d. per copy.

The *Journal* may be ordered through any Bookseller or Railway Bookstall, or it may be obtained direct from the Office of the Board (3, St. James's Square, London, S.W. 1).

NOTICES OF BOOKS.

Farmers' Clean Milk Book.—C. E. North, M.D. (New York, John Wiley & Sons, Inc. : London, Chapman & Hall, Ltd., 5s.). The author's primary object is to show that "clean milk" depends on the dairyman himself and the care he exercises in applying a few recognised rules in dealing with his milk, rather than on a large outlay on expensive buildings and equipment. "Cleanliness," he says, "is something many dairymen have always possessed but heretofore been unable to sell." Cleanliness costs money, it is expensive to keep utensils in good repair, to brush and wash cows, to milk carefully, to cool milk and to sterilize receptacles after use; therefore, he asserts, "certified milk" should receive a better price. The capital outlay, however, is small, and it depends on "the big three" of clean milk production—care in milking, proper cooling, sterilization of utensils. The point is very well illustrated in the account of a novel experiment carried out in 1915. Ten dairy farmers at Oxford, Pa., who had learnt how to produce clean milk, agreed to visit ten other farmers in the neighbouring district of Kelton to see what kind of milk they could produce in sheds they had never before visited. Tables showing the bacterial content of the milk produced by the Oxford farmers on the Kelton farms are compared with tables showing the bacterial content of milk produced by the Kelton farmers themselves, and demonstrate in a remarkable way the improvement which can be effected by care in milking and subsequent handling of the milk. The book also contains some useful notes on simple bacterial tests, and a chapter on the economics of milk production. It is freely illustrated.

MISCELLANEOUS NOTES.

The *International Crop Report and Agricultural Statistics* for October, 1919, published by the International Institute of Agriculture, gives particulars concerning the production of the

**Notes on Crop
Prospects and Live
Stock Abroad.**

cereal crops of 1919 in certain countries in the Northern Hemisphere.

Wheat.—The production in Spain, France, Scotland, Italy, Netherlands, Canada, United States, British India, Japan, and Tunis is estimated at 238,325,000 qr. in 1919, against 258,535,000 qr. in 1918, or a decrease of 7.8 per cent., the area sown showing an increase of 0.6 per cent.

Rye.—The estimated production in Spain, France, Italy, Netherlands, Canada, and the United States is placed at 19,326,000 qr. in 1919, or a decrease of 4.5 per cent. compared with 1918, when it amounted to 20,237,000 qr., but the area sown showed an increase of 6.0 per cent.

Barley.—The production in Spain, France, Scotland, Italy, Netherlands, Canada, United States, Japan, and Tunis is estimated to amount to 58,942,000 qr. in 1919, against 66,958,000 qr. in 1918, or a decrease of 12.0 per cent., the area sown being smaller by 5.9 per cent.

Oats.—It is estimated that the total yield in Spain, France, Scotland, Italy, Netherlands, Canada, United States, Japan, and Tunis amounts to 200,303,000 qr. in 1919, against 239,566,000 qr. in 1918, or a decrease of 16·3 per cent., the area sown being smaller by 3·0 per cent.

Maize.—The production in Spain, Italy, Canada, and the United States is estimated at 351,863,000 qr. in 1919, against 314,648,000 qr. in 1918, or an increase of 11·8 per cent., while the area sown showed a decrease of 4·0 per cent.

France.—According to the *Journal Officiel* of the 31st October, 1919, the condition of maize and potatoes on 1st October, 1919, was 54 and 51 respectively. (60 = fairly good and 50 = middling.)

Holland.—H.M. Consul-General at Rotterdam reports that the potato yield in Holland is expected to be fairly good or good and the quality good or very good. This description applies to Limburg, Guelderland, and Utrecht, to Orenthe, Overijssel and South Holland, Zeeland and North Brabant. Reports from Groningen, Friesland, and North Holland are fairly satisfactory, but on the sandy soils of South Groningen the crop has suffered from disease, while in several districts the tubers are small. The crop of onions is expected to be "from moderate to fairly good."

The production of the corn crops in Holland this year is estimated as follows (in quarters and 1918 figures in brackets):—Wheat, 750,000 (601,000); rye, 1,639,000 (1,189,000); barley, 320,000 (258,000); and oats, 2,161,000 (1,805,000). (*London Grain, Seed and Oil Reporter*, 4th November, 1919.)

Sweden.—According to an official report forwarded by H.M. Consul at Stockholm, the yield of the crops in Sweden was estimated on 30th September as follows, last year's figures being given in brackets (5 = very good, 4 = good, 3 = average, and 2 = small):—Winter wheat, 3·3 (3·0); winter rye, 3·2 (3·0); spring wheat, 3·0 (2·6); spring rye, 3·1 (2·6); barley, 3·6 (2·9); oats, 3·6 (2·8); mixed corn, 3·7 (2·9); hay (pasture), 3·2 (2·1); hay (rotation grasses), 3·3 (2·3); and potatoes, 3·4 (3·0).

Canada.—In a bulletin dated the 16th October, issued by the Dominion Bureau of Statistics, the total yield of this year's wheat crop in Canada is placed at 193,688,800 bush., as compared with 189,075,350 bush. last year. The production of barley is estimated at 66,443,500 bush. (77,287,240 bush. last year), and that of oats at 399,368,000 bush. (426,312,500 bush. last year). The quality at harvest time, expressed in percentages of the previous ten years, is as follows (1918 figures in brackets):—Wheat, 92 (98); barley, 89 (97); and oats, 90 (94).

United States.—The preliminary estimate of the Crop Recording Board of the Bureau of Statistics of the Department of Agriculture gives the production of maize this year in the United States as 2,910,000,000 bush., as compared with 2,582,814,000 bush. last year. It is estimated that 2·8 per cent. or 72,262,000 bush. of the 1918 crop was still in the hands of farmers on 1st November. This compares with 3·7 per cent. or 118,400,000 bush. on 1st November, 1918.

The production of linseed is estimated at 9,000,000 bush. as compared with 14,657,000 bush. last year. (*London Grain, Seed and Oil Reporter*, 8th November, 1919.)

Argentina.—The preliminary official estimate gives the areas under the crops this year as follows (in acres and figures for 1918 in brackets) :—Wheat, 14,950,000 (16,968,000) ; linseed, 3,520,000 (3,400,000) ; and oats, 2,300,000 (2,980,000). (*Broomhall's Corn Trade News*, 15th October, 1919.)

South Africa.—This year's maize crop in the Union of South Africa is officially estimated at 3,141,000 qr., as compared with 3,425,000 qr. in 1918, and 4,054,000 qr. the average for the five years 1913-17. (*London Grain, Seed and Oil Reporter*, 6th November, 1919.)

Tasmania.—The yield of the crops in 1918-19 in Tasmania is estimated as follows (1917-18 figures in brackets) :—Wheat, 186,570 bush. (252,383 bush.) ; oats, 848,420 bush. (589,224 bush.) ; and barley, 141,149 bush. (98,013 bush.). (*Broomhall's Corn Trade News*, 6th November, 1919.)

New Zealand.—According to the official preliminary returns the areas under the crops in 1918-19 are as follows (in acres, and figures for 1917-18 in brackets) :—Wheat, 209,404 (280,978) ; barley, 18,903 (18,860) ; and oats, 172,953 (156,202). The total yields are given as follows (in bush. and 1917-18 figures in brackets) :—Wheat, 6,658,613 (6,807,536) ; barley, 708,873 (568,702) ; and oats, 6,925,543 (4,942,759). (*London Grain, Seed and Oil Reporter*, 13th October, 1919.)

Live Stock in Denmark.—The number of pigs, according to the census of the 15th July, 1919, was 709,779, compared with 620,880 on the 15th July, 1918, 1,650,623 on the 12th July, 1917, and 2,496,706 on the 15th July, 1914. (*International Crop Report and Agricultural Statistics*, October, 1919.)

THE monthly crop report of the Board on 1st November was as follows :—The few outstanding corn crops in the hilly districts have now been all gathered in. Although the yields of

Agricultural Conditions in England and Wales on 1st November. all the three corn crops are short the quality and condition of the wheat are everywhere good ; and this is generally the case with barley also. Oats are not so good : in most cases they are satisfactory, but in some parts the quality is reported to be inferior. The straw of all three cereals is short.

The bulk of the potato crop has now been lifted ; the tubers are generally small, so that the crop is light, but they are sound, and unusually free from disease, except in the south-west, where a certain amount is reported. Variable progress has been made with pulling mangolds ; over most of the country the work is in full swing. The crop is light, but the roots are sound. Very few turnips or swedes have yet been lifted, as they are still growing. They have generally improved somewhat during the month, but are nevertheless still a very small crop.

Very good progress has been made with autumn cultivation, the weather throughout the month having been most favourable, although,

particularly in the south-eastern half of the country, the ground has in some few places been too dry to work or drill. On the whole, however, the work is well forward for the time of year, and a large proportion of the winter corn has been sown, the seed going into a good seed-bed. In some instances, in the south, the young plants are showing above ground, and look well.

* Seeds are very variable, even in the same neighbourhood, but they are not satisfactory as a whole, being often only a thin plant. A considerable amount of ploughing up and patching has been necessary. Some improvement may, however, be noted during the month in many areas.

Live stock have done fairly well during October, but the pastures were getting bare at the end of the month. The outlook for winter keep is far from promising, roots and hay being everywhere short.

There has generally been a sufficiency of labour of an ordinary kind, although in some parts difficulty has been experienced with potato-lifting or mangold-pulling. Skilled and experienced men of all kinds however, continue to be scarce.

The following local summaries give details regarding agricultural labour in the different districts of England and Wales in October :—

Northumberland, Durham, Cumberland, and Westmorland.—The supply of all kinds of **Agricultural Labour in England and Wales during October.** labour is sufficient, except in South Cumberland and South-east Durham, where skilled men are required, and in North Durham where there is a general shortage.

Lancashire and Cheshire.—In most districts the supply of labour is equal to the demand, which, on account of favourable weather and poor yields is rather less than usual. In North-east Cheshire and part of East Lancashire temporary labour is insufficient, while in South-east Cheshire there is a shortage of all kinds.

Yorkshire.—Labour is sufficient in most districts, though there is still a shortage of skilled men, and temporary labour for root-lifting is sometimes scarce. Schoolboys have eased the situation in this respect in some districts.

Shropshire and Stafford.—In most districts the supply of labour is sufficient for requirements, though there is a scarcity of both casual labour and skilled men in some parts of the district.

Derby, Nottingham, Leicester, and Rutland.—Except in North and North-east Derby, where there is a shortage of all kinds, the supply of labour is about equal to the demand, but occasionally a shortage of skilled men is reported.

Lincoln and Norfolk.—There is sufficient labour in practically all districts, though here and there experienced men are still scarce.

Suffolk, Cambridge, and Huntingdon.—The supply of labour is generally sufficient for all requirements. Good horsemen, stockmen, and milkers are, however, still in request.

Bedford, Northampton, and Warwick.—In most districts the supply of labour is sufficient. In the north of Northampton, however, it is reported to be deficient generally. There is some shortage of skilled men in Warwickshire.

Buckingham, Oxford, and Berkshire.—In the division as a whole the supply of labour is about sufficient, but there are local shortages of skilled men, and to a less extent, of casual workers.

Worcester, Hereford, and Gloucester.—On the whole the supply of labour is sufficient for requirements.

Cornwall, Devon, and Somerset.—The supply of labour in most districts is sufficient for requirements, though sometimes of inferior quality, but skilled men are still scarce, and occasionally temporary labour has been difficult to obtain for potato and root lifting.

Dorset, Wiltshire, and Hampshire.—The supply of labour is almost everywhere sufficient, or even abundant. In South-west Dorset a shortage of skilled thatchers and hurdle makers is reported.

Surrey, Kent, and Sussex.—The supply of labour is, on the whole, sufficient, although occasional shortages of skilled men are reported.

Essex, Hertford, and Middlesex.—In Middlesex and West Herts the supply of all kinds of labour is reported to be deficient, and a shortage of skilled men is reported in East and North Essex. Elsewhere the supply is adequate.

North Wales.—The supply of labour on the whole is sufficient for requirements, though skilled men are sometimes scarce.

Mid Wales.—In Brecon and parts of Cardigan there is a shortage of labour, chiefly in the latter county, of skilled men, but elsewhere the supply is generally equal to the demand.

South Wales.—The supply of labour has improved somewhat in several districts, and is mostly sufficient for requirements, but there is still a shortage of skilled men in some parts, and occasionally a deficiency of casual labour for potato and root lifting.

AVERAGE PRICES of British Wheat, Barley, and Oats at certain Markets during the Month of October, 1917, 1918, and 1919.

	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919.	1917.	1918.	1919.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	72 4	74 3	75 1	60 9	60 8	98 0	44 8	59 0	63 4
Norwich ...	71 2	72 4	72 11	59 6	60 1	95 6	43 3	50 4	60 7
Peterborough ...	70 6	72 1	72 7	56 7	60 1	92 4	43 1	47 9	58 8
Lincoln ...	70 10	72 5	73 2	58 11	60 5	95 2	44 6	62 11	60 10
Doncaster ...	70 0	71 10	73 8	56 0	59 10	92 11	41 2	48 4	60 3
Salisbury ...	72 11	72 5	73 2	59 3	60 4	93 8	52 9	50 5	56 3

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1917, 1918 and 1919.

Weeks ended (in 1919).	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919.	1917.	1918.	1919.
Jan. 4 ...	s. d. 76 0	s. d. 71 2	s. d. 72 2	s. d. 60 4	s. d. 58 0	s. d. 62 3	s. d. 47 1	s. d. 45 5	s. d. 48 8
" 11 ...	75 8	71 2	72 6	65 7	58 2	62 5	47 2	46 9	49 8
" 18 ...	75 8	71 3	72 7	64 9	58 1	62 3	47 4	47 9	50 0
" 25 ...	75 10	71 1	72 7	64 5	58 7	61 10	47 8	48 2	49 6
Feb. 1 ...	75 10	71 2	72 8	64 0	58 10	62 4	47 3	50 2	49 7
" 8 ...	76 0	72 0	72 7	63 5	59 0	62 3	46 11	50 6	49 2
" 15 ...	76 3	72 3	72 8	63 8	58 11	62 5	47 3	52 0	49 0
" 22 ...	76 9	72 2	72 8	63 9	58 9	62 6	47 8	52 3	49 4
Mar. 1 ...	77 4	72 2	72 7	64 0	57 9	62 7	48 0	52 0	48 8
" 8 ...	78 0	72 3	72 6	63 7	58 5	62 7	48 7	52 2	48 6
" 15 ...	78 10	72 4	72 5	64 1	56 10	62 5	49 4	51 0	46 8
" 22 ...	80 3	72 3	72 7	65 6	56 9	62 1	50 4	50 3	46 4
" 29 ...	81 5	72 4	72 7	71 10	56 7	62 8	51 10	48 10	46 11
Apl. 5 ...	84 4	72 11	72 6	69 11	56 7	62 8	55 1	49 10	47 2
" 12 ...	85 2	73 3	73 0	71 10	56 6	62 9	57 2	47 2	47 1
" 19 ...	84 10	73 3	73 1	70 6	56 6	62 9	59 8	47 0	47 3
" 26 ...	81 1	73 3	73 1	69 5	56 10	62 9	58 6	46 8	48 1
May 3 ...	77 7	73 5	73 2	64 4	56 5	62 8	54 9	47 4	48 7
" 10 ...	78 0	73 5	73 2	64 11	56 6	63 1	55 2	47 6	47 5
" 17 ...	77 11	73 4	73 3	64 10	56 6	62 4	55 2	46 4	47 11
" 24 ...	78 0	73 3	73 2	64 9	56 6	62 7	54 11	47 8	47 11
" 31 ...	78 0	73 8	73 3	65 11	60 0	62 7	54 11	44 9	48 3
June 7 ...	78 0	73 11	73 2	67 7	59 2	62 6	55 0	45 5	47 10
" 14 ...	78 2	74 3	73 3	75 6	57 9	62 8	55 1	46 10	48 11
" 21 ...	78 1	74 4	73 3	75 0	58 5	62 8	55 2	47 8	48 7
" 28 ...	78 3	74 4	73 3	73 11	57 10	63 4	55 1	46 4	49 1
July 5 ...	78 1	74 4	73 4	69 5	61 7	62 4	55 2	46 10	49 0
" 12 ...	78 2	74 4	73 3	70 10	57 5	63 1	55 1	47 0	49 11
" 19 ...	78 3	74 3	73 4	72 1	60 5	62 9	55 2	45 4	49 11
" 26 ...	78 3	74 3	73 4	65 7	56 11	63 4	55 2	46 2	48 11
Aug. 2 ...	78 2	74 3	73 3	73 6	57 1	62 10	55 0	45 10	50 3
" 9 ...	78 4	74 7	73 4	76 1	57 7	73 8	55 0	46 3	55 6
" 16 ...	78 7	74 2	73 3	68 11	61 4	75 2	55 6	55 11	61 4
" 23 ...	76 7	74 8	73 10	70 7	62 6	83 4	54 7	56 9	62 0
" 30 ...	72 1	74 8	73 3	60 4	60 1	86 7	49 0	57 11	61 10
Sept. 6 ...	71 6	72 3	73 4	59 3	60 4	89 3	46 7	56 9	61 1
" 13 ...	70 7	72 5	73 5	57 2	60 1	92 5	45 0	49 2	62 4
" 20 ...	70 8	72 6	73 4	56 10	60 4	94 7	45 8	49 11	61 3
" 27 ...	70 6	72 7	73 0	58 5	60 3	95 2	44 7	50 3	60 2
Oct. 4 ...	70 8	72 8	73 4	57 9	60 3	94 4	44 9	50 9	59 6
" 11 ...	71 0	72 6	73 1	58 5	60 3	95 5	44 5	51 6	58 10
" 18 ...	70 8	72 7	73 0	59 3	60 3	97 10	44 1	50 9	57 9
" 25 ...	70 10	72 5	73 0	60 1	60 3	95 1	43 0	50 5	57 5
Nov. 1 ...	70 4	72 4	72 9	59 11	60 3	96 0	42 4	50 8	56 4
" 8 ...	70 3	72 4	72 8	60 2	60 3	97 10	42 11	49 11	55 3
" 15 ...	70 3	72 5		60 2	60 3		43 0	49 10	
" 22 ...	70 2	72 4		59 9	60 10		43 1	51 1	
" 29 ...	70 2	72 3		59 3	62 2		44 6	50 4	
Dec. 6 ...	70 7	72 4		58 7	62 6		43 5	51 4	
" 13 ...	71 2	72 3		58 8	62 7		43 6	51 4	
" 20 ...	71 1	72 4		57 7	62 3		44 2	50 5	
" 27 ...	71 1	72 3		57 7	62 3		44 10	50 6	

NOTES.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in October and September, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	OCTOBER.		SEPTEMBER.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
FAT STOCK :—	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	79 1	74 2	79 2	74 0
Herefords	78 7	73 7	79 0	73 8
Shorthorns	78 8	73 10	78 8	73 9
Devons	78 8	73 8	78 6	73 10
Welsh Runts	78 6	74 0	77 8	73 8
Fat Cows	73 9	65 9	73 9	65 9
	First Quality. per lb.*	Second Quality. per lb.*	First Quality. per lb.*	Second Quality. per lb.*
	d.	d.	d.	d.
Veal Calves	14½	12½	10½	9
Sheep :—				
Downs	14½	14½	14½	14½
Longwools	14½	14½	14½	14½
Cheviots	14½	14½	14½	14½
Blackfaced	14½	14½	14½	14½
Welsh	14½	14½	14½	14½
Cross-breds	14½	14½	14½	14½
	per score. live weight.	per score. live weight.	per score. live weight.	per score. live weight.
	s. d.	s. d.	s. d.	s. d.
Pigs :—				
Bacon Pigs	21 0	21 0	21 0	21 0
Porkers	21 0	21 0	21 0	21 0
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	54 1	40 17	53 8	39 11
„ —Calvers ...	48 8	37 15	49 15	37 15
Other Breeds—In Milk ...	46 2	35 2	45 4	33 4
„ —Calvers ...	33 0	28 0	32 0	26 10
Calves for Rearing	3 12	2 13	3 6	2 8
Store Cattle :—				
Shorthorns—Yearlings ...	14 19	12 6	15 11	12 17
„ —Two-year-olds... ..	26 10	21 11	26 14	21 12
„ —Three-year-olds ...	36 19	31 10	37 0	31 7
Herefords—Two-year-olds...	27 16	23 14	26 9	21 5
Devons— „ ...	27 6	22 14	28 3	23 17
Welsh Runts— „ ...	27 0	—	—	21 0
Store Sheep :—				
Hogs, Hoggets, Togs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	63 3	51 3	58 10	49 0
Store Pigs :—				
8 to 12 weeks old	49 4	36 6	56 3	41 2
12 to 15 „ „	89 3	71 2	94 5	74 0

* Estimated carcass weight.

NOTE.—The prices per lb. for sheep do not include the value of the skins or pelts, which during October made prices equivalent to an additional 2d. per lb. of the carcass weight for Downs, Blackfaced, Welsh, and Crossbreds, and 3d. for Longwools and Cheviots, and during September, 1½d. per lb. for Downs, Blackfaced and Welsh, 2d. for Longwools and Crossbreds, and 3d. for Cheviots.

**AVERAGE PRICES of PROVISIONS, POTATOES and HAY at
certain MARKETS in ENGLAND in October, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER :—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
British	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
	—	—	—	—	27 6	—
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
„ Factory	—	—	—	—	—	—
Imported (Controlled)	252 0	—	252 0	—	252 0	—
CHEESE :—						
British—						
Cheddar	144 6	—	—	—	144 6	—
Cheshire	—	—	120 lb. 155 0	—	120 lb. 155 0	—
Canadian	144 6	—	per cwt. 144 6	—	per cwt. 144 6	—
BACON :—						
Irish (Green)	195 6	—	195 6	—	195 6	—
Canadian (Green sides)	192 0	—	192 0	—	192 0	—
HAMS :—						
York (Dried or Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green) (long cut)	195 0	—	195 0	—	195 0	—
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	50 0	49 7
Irish	48 7	—	45 7	44 0	46 0	44 0
American	37 3	—	34 0	32 7	35 2	33 2
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
British Queen... ..	216 0	186 0	213 6	190 0	222 0	204 0
Arran Chief	216 0	180 0	—	—	222 0	202 0
Other Late Varieties ..	218 0	186 0	223 6	180 0	222 0	200 0
HAY :—						
Clover	—	—	—	—	295 0	275 0
Meadow	—	—	—	—	290 0	270 0

**AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in October, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.				Quality.	Birming- ham.	Leeds.	Liver- pool.	London.	Man- chester.
					per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
					s. d.	s. d.	s. d.	s. d.	s. d.
BEEF :—									
English	1st	...	...	1st	133 6	133 6	—	133 6	133 6
	2nd	...	...	2nd	133 6	133 6	—	133 6	133 6
Cow and Bull	1st	...	...	1st	133 6	133 6	133 6	133 6	133 6
	2nd	...	...	2nd	133 6	133 6	115 0	117 0	115 0
Irish : Port Killed	1st	...	...	1st	—	—	—	134 6	—
	2nd	...	...	2nd	—	—	—	134 6	—
Argentine Frozen—									
Hind Quarters	...	1st	...	1st	121 0	121 6	122 0	121 6	123 6
Fore „	...	1st	...	1st	89 0	90 0	89 6	90 0	93 6
Australian Frozen—									
Hind Quarters	...	1st	...	1st	121 0	118 6	—	121 6	114 6
Fore „	...	1st	...	1st	89 0	84 6	—	90 0	78 0
Brazilian Frozen—									
Hind Quarters	...	1st	...	1st	—	—	—	121 0	—
Fore „	...	1st	...	1st	—	—	—	89 0	—
VEAL :—									
British	1st	...	...	1st	95 6	98 0	—	96 6	98 0
	2nd	...	...	2nd	—	76 6	—	83 6	98 0
MUTTON :—									
Scotch	1st	...	...	1st	141 6	140 6	143 6	141 6	140 6
	2nd	...	...	2nd	141 6	140 6	143 6	141 6	140 6
English	1st	...	...	1st	140 6	140 6	—	140 6	140 6
	2nd	...	...	2nd	140 6	140 6	—	140 6	143 6
Irish : Port Killed	1st	...	...	1st	—	—	—	—	—
	2nd	...	...	2nd	—	—	—	—	—
Argentine Frozen				...	1st	112 0	112 6	112 6	113 6
New Zealand „				...	1st	—	—	112 6	115 6
Australian „				...	1st	—	—	112 6	—
LAMB :—									
British	1st	...	...	1st	140 6	140 6	140 6	141 6	140 6
	2nd	...	...	2nd	140 6	140 6	140 6	141 6	140 0
New Zealand	...	1st	...	1st	108 6	108 6	—	112 6	115 6
Australian...	...	1st	...	1st	—	119 0	—	112 6	—
Argentine ...	...	1st	...	1st	112 0	112 6	—	112 6	119 0
PORK :—									
British	1st	...	...	1st	—	—	149 6	149 6	149 6
	2nd	...	...	2nd	—	—	—	—	—
Frozen	1st	...	...	1st	—	—	—	133 0	—

DISEASES OF ANIMALS ACTS 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	25	15	176	204
Animals attacked	35	16	233	235
Foot-and-Mouth Disease :—				
Outbreaks	21	2	49	3
Animals slaughtered as diseased or exposed to infection ...	169	32	1,762	40
Glanders (including Farcy) :—				
Outbreaks	1	3	21	28
Animals attacked	4	7	54	77
Parasitic Mange :—				
Outbreaks	126	131	4,323	3,700
Animals attacked	202	207	8,669	6,936
Rabies :—				
Number of cases	5	39	151	47
„ „ Dogs affected ...	3	38	146	45
„ „ other animals affected ...	2	1	5	2
Sheep-scab :—				
Outbreaks	41	5	266	265
Swine Fever :—				
Outbreaks	210	115	1,917	1,180
Swine slaughtered as diseased or exposed to infection ...	97	35	890	463

IRELAND*(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)*

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	—	—	—	2
Animals attacked	—	—	—	2
Glanders (including Farcy) :—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Parasitic Mange :—				
Outbreaks	4	—	130	92
Sheep-scab :—				
Outbreaks	34	34	220	256
Swine Fever :—				
Outbreaks	1	2	30	24
Swine slaughtered as diseased or exposed to infection ...	1	4	93	76

The Weather in England during October.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	*F.	*F.	In.	Mm.*	Mm.*		Hours.	Hours.
<i>Week ending 4th Oct.:</i>								
England, N.E. ...	48.9	-2.3	0.09	2	-13	2	6.0	+2.3
England, E. ...	47.8	-4.5	0.23	6	-7	2	7.2	+3.4
Midland Counties ...	47.1	-3.7	0.17	4	-10	1	6.4	+3.1
England, S.E. ...	48.7	-4.5	0.15	6	-14	2	6.8	+2.9
England, N.W. ...	49.5	-3.1	0.36	9	-12	3	6.7	+1.3
England, S.W. ...	49.3	-3.6	0.28	7	-17	2	7.4	+3.6
English Channel ...	54.0	-1.8	0.20	5	-16	2	7.6	+3.2
<i>Week ending 11th Oct.:</i>								
England, N.E. ...	48.8	-0.7	0.23	6	-12	4	5.0	+1.7
England, E. ...	49.0	-1.8	0.26	7	-9	3	4.3	+0.9
Midland Counties ...	47.0	-2.5	0.04	1	-18	1	5.4	+2.3
England, S.E. ...	49.4	-2.3	0.01	0	-19	1	5.0	+1.3
England, N.W. ...	49.0	-1.2	0.17	4	-18	2	4.6	+1.6
England, S.W. ...	49.4	-1.9	0.10	3	-24	2	5.2	+1.8
English Channel ...	54.8	+1.8	0.20	5	-18	1	5.0	+0.7
<i>Week ending 18th Oct.:</i>								
England, N.E. ...	42.6	-5.7	0.36	9	-9	3	4.2	+1.3
England, E. ...	41.8	-7.7	0.30	8	-7	3	4.6	+1.4
Midland Counties ...	42.6	-5.4	0.22	6	-11	3	4.7	+1.8
England, S.E. ...	42.8	-7.9	0.14	4	-15	2	5.7	+2.3
England, N.W. ...	44.5	-4.6	0.73	19	-3	3	3.8	+1.1
England, S.W. ...	45.2	-5.4	0.27	7	-18	3	5.2	+1.9
English Channel ...	49.8	-4.1	0.55	14	-9	4	6.8	+2.7
<i>Week ending 25th Oct.:</i>								
England, N.E. ...	47.3	+0.9	0.87	22	+4	3	3.1	+0.5
England, E. ...	45.6	-0.5	0.09	2	-14	2	3.8	+0.9
Midland Counties ...	47.0	+0.9	1.37	35	+18	2	3.1	+0.6
England, S.E. ...	47.8	-0.7	0.32	8	-16	2	4.0	+1.0
England, N.W. ...	49.1	+2.3	1.30	33	+10	3	2.4	-0.2
England, S.W. ...	50.5	+1.9	1.20	30	+3	2	2.5	-0.4
English Channel ...	52.8	+0.5	0.46	12	-16	3	3.3	-0.1
<i>Week ending 1st Nov.:</i>								
England, N.E. ...	40.8	-5.2	2.05	52	+37	7	2.6	+0.4
England, E. ...	41.0	-5.9	1.10	28	+12	6	2.4	+0.2
Midland Counties ...	40.0	-5.7	0.52	13	-5	4	3.2	+0.9
England, S.E. ...	40.8	-7.5	0.32	8	-15	3	3.1	+0.3
England, N.W. ...	41.9	-4.8	0.17	4	-20	3	3.6	+1.5
England, S.W. ...	41.1	-7.0	0.24	6	-23	3	4.5	+2.0
English Channel ...	46.6	-5.0	0.56	14	-10	6	4.0	+0.9

* 1 inch = 25.4 millimetres.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

- Office of Works.*—Report on the Cultivation of Certain Areas in the Royal Parks (4 pp.) [Cmd. 114] London: H.M. Stationery Office, 1919. 1d. net. [33.58.]
- British Museum (Natural History)*—A Monograph of the British Lichens: A Descriptive Catalogue by *A. L. Smith*. Part I. [Second Edition] (520 pp. + 71 pl.) London: British Museum (Natural History), 1918. [58.2.]
- Pethybridge, G. H.*—Is it possible to distinguish the Seeds of Wild White Clover from those of Ordinary White Clover by Chemical Means during a Germination Test? (248–258 pp.). [Econ. Proc. R. Dub. Soc., Vol. ii., No. 14, May, 1919.] London: Williams & Norgate, 1919. 6d. [63.1951; 63.33(b).]
- Hickel, R.*—Graines et Plantules des Arbres et Arbustes indigènes et communément cultivés en France. I. Conifères (179 pp.). II. Angiospermes (349 pp.). Versailles: L'Auteur, 11 bis, Rue Champ-la Garde, 1911–14. [63.1951; 58(02).]
- Horticultural Education Association.*—Contributions to the Reconstruction of Horticultural Education (32 pp.) [1919.] [37.635.]
- Weigall, A. G., and Wrey, Castell.*—A Large State Farm: A Business and Educational Undertaking (82 pp.). London: John Murray, 1919. 2s. 6d. net. [63.191; 371.]
- U. S. Department of Agriculture.*—Farmer's Bull. 1045:—Laying out Fields for Tractor Ploughing (40 pp.). Washington, 1919. [63.196.]
- Bainbridge, F.*—The Effect of Fluorspar Additions on the Phosphates in Basic Slag (8 pp.). Iron and Steel Institute, 1919. [63.1672.]
- Dendy, A. (Edit.)*—Animal Life and Human Progress (227 pp.). London: Constable & Co., 1919. 10s. 6d. [59.16.]
- Wahnschaffe, F., und Schucht, F.*—Anleitung zur wissenschaftlichen Bodenuntersuchung (3e Auflage) (216 pp.). Berlin: Paul Parey, 1914. [63.113.]
- Royal Danish Agricultural Society.*—A Short Survey of Danish Agriculture (64 pp.). Copenhagen, 1913. [63(489).]
- O'Shea, T. J.*—Farming and Planting in British East Africa (162 pp.). London and Nairobi: Newland, Tarlton & Co., 1917. [63(6).]
- Robison, E. (Edit.)*—Vocational Education (303 pp.). New York: H. W. Wilson & Co., 1917. \$1.25 net. [37(02); 371.]
- Armstrong College.*—Cockle Park Bull. 29:—Guide to Experiments in 1919 (87 pp.). Newcastle-on-Tyne, 1919.
- Lovell, J. H.*—The Flower and the Bee: Plant Life and Pollination (286 pp. + 119 figs.). London: Constable & Co., 1919. 10s. 6d. net. [58(02); 63.81(02); 63.41(a).]
- Thomson, J. A.*—Heredity [Third Edition] (627 pp.). London: John Murray, 1919. 15s. net. [575.1.]
- Powell-Owen, W.*—A Living from the Land (144 pp.). London: George Newnes, 1919. 5s. net. [63(022).]

Field Crops—

- British East Africa, Department of Agriculture.*—Bull. 3:—Hints on Flax Cultivation and Flax Culture (10 pp.). Nairobi, 1919. [63.34111.]
- Board of Trade.*—Interim Report of the Empire Flax Growing Committee on the General Situation and Immediate Prospects of Supply in April, 1919 (11 pp.). [Cmd. 281.] London: H.M. Stationery Office, 1919. 2d. net. [63.34111.]
- Lane, D. Y.*—The World's Wheat (40 pp.). Liverpool: Northern Publishing Company, 1916. 2s. 6d. [63.311; 31.]

Horticulture—

- Trenkle, R.*—Der Gemüsesamenbau (139 pp.). Stuttgart: Eugen Ulme 1919. 2M. 60. [63.1951; 63.51(02).]
- Lansdell, J.*—Grapes and how to Grow them (114 pp.). London: W. H. & L. Collingridge, 1919. 3s. 6d. [63.46.]
- Moore, Sir F.*—Horticultural Resources [of Ireland] (20 pp.). Dublin: Royal Dublin Society, 1919. 6d. [63.41(415).]

Dairying and Food, General—

- Sheehy, E. J.*—Possible Causes of Variation in the Quantity and Quality of Cows' Milk (585–596 pp.) [Sci. Proc. Roy. Dub. Soc., Vol. xv. (N.S.), No. 42, May, 1919.] London: Williams & Norgate, 1919. 6d. [63.712; 612.664.]
- Sheehy, E. J.*—The Comparative Variation of the Constituent Substances of Cows' Milk (574–584 pp.) [Sci. Proc. Roy. Dub. Soc., Vol. xv. (N.S.), No. 41, May, 1919.] London: Williams & Norgate, 1919. 6d. [63.712; 612.664.]
- Sheehy, E. J.*—An Economic Method of Determining the Average Percentage of Fat in a Cow's Milk for a Lactation Period (546–573 pp.) [Sci. Proc. Roy. Dub. Soc., Vol. xv. (N.S.), No. 40, May, 1919.] London: Williams & Norgate, 1919. 1s. [63.712.]
- Yeld, Ellen.*—Practical Cheese making for Smallholders, Farmers and Others (Fifth Edition) (55 pp.) Leominster: Orphans' Printing Press, 1919. 2s. net. [63.7(02).]
- Thom, C., and Fisk, W. W.*—The Book of Cheese (392 pp.) New York and London: The Macmillan Company, 1918. 8s. [63.73(02).]
- Guernon, F.*—On Milch Cows: a Treatise on the Bovine Species in General (translated by H. Hand) (131 pp.) New York: Orange Judd Company, 1918. [63.711(02).]
- Select Committee (Lords) on Milk Production.*—Report on the Prices fixed by the Ministry of Food (2 pp.) [H.L. 161.] London: H.M. Stationery Office, 1919. 1d. net. [63.714.]
- Ministry of Food.*—Report of Travelling Commission of Enquiry into the Cost of Production of Milk (14 pp.) [Cmd. 233.] London: H.M. Stationery Office, 1919. 2d. net. [63.714.]
- Hunziker, O. F.*—Condensed Milk and Milk Powder (Second Edition) (317 pp.) The Author, La Grange, Illinois, 1918. [63.715.]
- Committee on the Production and Distribution of Milk.*—Third Interim Report (30 pp.) [Cmd. 315.] London: H.M. Stationery Office, 1918. 3d. net. [63.714.]
- West of Scotland Agricultural College.*—Bull. 92:—Experiments in the Manufacture of Rennet (36 pp. + 3 pl.) Glasgow, 1919. [63.73(04).]
- Hill, C. L.*—The Guernsey Breed (415 pp.) Waterloo, Iowa: Fred I. Kimball Company, 1917. [63.711.]

Birds, Bees and Poultry—

- West of Scotland Agricultural College.* Bull. 91:—Report on the Demonstration Poultry Crofts at Tiree and Glenluce (11 pp.) Glasgow, 1919. [63.651(04).]
- Paynter, F. G.*—Paynter's System of Poultry Rearing or £500 a Year from Hens (162 pp.) [Second Edition.] London: "Country Life," 1919. 5s. net. [63.651(02).]
- West of Scotland Agricultural College.*—Bull. 93:—The Production of Honey (56 pp.) Glasgow, 1919. [63.81(04).]
- Departmental Committee on the Protection of Wild Birds.*—Report (44 pp.) [Cmd. 295.] London: H.M. Stationery Office, 1919. 6d. net. [59.162.]
- Hurst, J. W.*—Utility Ducks and Geese: Their Successful Management for Egg and Meat Production (93 pp.) London: Constable & Co., 1919. 2s. 6d. net. [63.657; 63.658.]

Economics—

- Balinsky, P.*—The Problem of Land Ownership: A Proposal for its Rational Solution (96 pp.) New York: Privately Printed, 1919. [333.5.]
- Turnor, C.*—Land Nationalisation (77–93 pp.) [Journal of the Farmers' Club, June, 1919.] [338.99; 333.5.]

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

- Farm Budgeting and Planning, *F. H. Purchas*. (Estate Mag., August, 1919.) [657.]
- Potash Recovery at Cement Plants, *A. W. G. Wilson*. (Jour. Soc. Chem. Indust., August 15, 1919.) [63.1673.]
- The Breaking up of Permanent Grass in 1918, *C. Bryner Jones*. (Jour. Roy. Agric. Soc., Vol. 79, 1918.) [63.196.]
- Modern Haymaking and Haymaking Machinery, *J. R. Bond*. (Jour. Roy. Agric. Soc., Vol. 79, 1918.) [63.1982; 63.17(04).]
- The Uses of Weeds and Wild Plants, *W. E. Brenchley*. (Science Progress, July, 1919.) [58.16; 63.259(04).]
- Die Zukunft des höheren forstlichen Unterrichts in Preussen, *Dr. Möller*. (Zeit. Forst. u. Jagd., Juli, 1919.) [37: 634.]
- The Influence of Heated Soils on Seed Germination and Plant Growth, *J. Johnson*. (Soil Science, January, 1919.) [63.115.]
- A Survey of the Development of the Servian Nation, *G. Diouritch*. (Jour. Roy. Stat. Soc., May, 1919.) [63(4).]
- Reclamation of Peat Bogs (Jour. Roy. Soc. Arts, 11th July, 1919.) [662.6.]
- Soil Making, *E. J. Russell*. (Jour. Roy. Hort. Soc., May, 1919.) [63.11(04).]

Field Crops—

- Cultivation of Carobs in Algeria (Jour. Roy. Soc. Arts, 27th June, 1919.) [63.342.]
- New Zealand Flax. (Roy. Bot. Gard., Kew, Bull. Misc. Inform., No. 4, 1919.) [63.341.]
- Conference on the Production and Consumption of Sugar within the British Empire. (Jour. Soc. Chem. Indust., 15th August, 1919.) [63.313.]
- A Note on the Economy of Silos in Farm Management, *F. Smith*. (Jour. Roy. Agric. Soc., Vol. 79, 1918.) [63.1985.]

Horticulture—

- Food Value of Vegetables, *F. Stoker*. (Jour. Roy. Hort. Soc., May, 1919.) [63.51(04).]
- Relation of Weather to Fruitfulness in the Plum, *M. J. Dorsey*. (Jour. Agric. Research, June 16th, 1919.) [63.41(a).]

Plant Diseases—

- The Difficulties of Growing Red Clover—Clover Sickness and other Causes of Failure, *A. Amos*. (Jour. Roy. Agric. Soc., Vol. 79, 1918.) [63.33(b).]
- Root-Knot (Eel Worm) Disease of Tomatoes, *R. Robson*. (Jour. Roy. Hort. Soc., May, 1919.) [63.27.]
- The "Brown Rot" Diseases of Fruit Trees, with Special Reference to two Biologic Forms of *Monilia cinerea*, I., *H. Wormald*. (Ann Botany, July, 1919.) [63.24; 63.24—41.]

Forestry—

- Die Kienölgewinnung im Wald von Bialowics, *A. Parst*. (Natur. Zeit. Forst. u. Land., April/Mai, 1919.) [63.49—197.]

Engineering—

- Crop-Cycles in the United Kingdom and in the United States, *H. L. Moore*. (Jour. Roy. Stat. Soc., May, 1919.) [551.5.]
- The Work of the Motor Tractor, *G. H. Garrad*. (Jour. Roy. Agric. Soc., Vol. 79, 1918.) [63.175.]

Economics—

- Tithes, Corn Rents, and Tithe Rentcharge, *P. W. Millard*. (Jour. Roy. Agric. Soc., Vol. 79, 1918.) [348.]

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DECEMBER, 1919.

EDITORIAL NOTES.

WITH the passing of the Agriculture (Councils) Bill through the House of Commons, a big step has been taken towards that re-organisation of agriculture which is recognised as one of the paramount needs of our time. It is often forgotten that the Board did not come into being as a great administrative department; they merely took over the administration of certain Acts of Parliament and issued general advice to those who cared to avail themselves of the ever-growing fruits of modern knowledge. To-day the whole position is changed. The Board are entrusted with many important tasks. They stimulate food production, direct and control cultivation, assist and supervise research work and education, and, in short, look after all interests, large and small, that are concerned with the production of home-grown food supplies. The Prime Minister has said that agriculture is still the nation's largest and most important industry, and it follows that in the conduct of that industry the President and the Board must have the best advice obtainable. To this end a Council of Agriculture for England and a Council of Agriculture for Wales, with a smaller Advisory Committee for both England and Wales, are being established, while each County will set up its own Local Agriculture Committee. The procedure is not very complicated. To each County Council's Agricultural Committee at least one-third of the members will be nominated by the Board. All purely agricultural questions that are now brought to the County Councils will be referred to these committees, while sub-committees will deal with animal diseases, small holdings and allotments, land drainage, the control of cultivation, and like questions, though in the two last instances specified they will exercise the powers of and take instructions from the Board.

The Agricultural Councils for England and Wales will be made up of representatives of the Local Agricultural Committees, and a certain element nominated by the Board, which will include representatives of Labour, Women, Horticulture, and Agricultural Education and Research. The Agricultural Wages Board will also be represented. These Councils will meet at least twice a year to discuss agricultural questions of general interest. There will be a much smaller body called the Agricultural Advisory Committee, composed of twelve members representing both England and Wales, nominated in part by the English and Welsh Councils and in part by the Board, which will meet at least once a quarter, and perhaps more often, and form an Advisory Committee for the assistance of the President. In this way the agricultural community will have the means which it has long desired of expressing its views on agricultural policy and of making known to the President, in whom the responsibility is vested, its opinions of agricultural affairs by the Board.

It will be seen that the Bill bears the fruit of a hard-won knowledge gained during the years of war. It was found then that the County Agricultural Executive Committees, composed of the best agriculturists in each district, showed both administrative and executive capacity of a kind that was invaluable to the country. Clearly gifts like theirs are too valuable to agriculture to be withdrawn from its service now that peace has brought fresh problems that demand for their wise solution the best advice, the most alert agricultural intelligence and the greatest public spirit.

TOWARDS the end of November, the Military Authorities notified the Board that all prisoners of war working in agriculture had been repatriated and all parent and working camps closed. In view of the conclusion of a remarkable piece of work it is perhaps of interest to recall the conditions under which prisoners aided the great task of food production. Their earliest employment dates from the beginning of 1917, and until the last camp closed the prisoners remained under the control and in the custody of the Military Authorities. Their work and the allocation of their labour were left to the Food Production Department of the Board acting through the County War Agricultural Executive Committees. The total number of men allotted to the Food Production Department for agricultural

**German Prisoners
on English Farms.**

work varied from time to time. In January, 1919, there were over 30,000; when repatriation began in September last rather more than 25,000 remained. Prisoners were divided into four classes:—

- (1) Those working from depots, who went daily to the farms and returned to the camp at night;
- (2) Prisoners boarding and lodging with farmers, who were responsible for their safe custody;
- (3) Prisoners working from parent camps;
- (4) Migratory gangs of ten men in charge of a single guard.

Farmers were required to pay the standard rate of wages prevailing in the district, and out of this pay prisoners received 2*d.* an hour if non-commissioned officers, 1½*d.* if skilled workmen and 1*d.* an hour if ordinary workers. The day averaged from eight to nine hours with occasional overtime for which prisoners were paid at double rates. There was an arrangement by which prisoners were to be withdrawn from farms in any neighbourhood where there was unemployment among agricultural labourers, but there were few complaints, because it is only of late that the great labour shortage in rural England has been overcome. Every kind of agricultural work was undertaken by the Germans, including skilled market gardening by selected men, the preparation of land for trees, tree planting, the cleansing of water courses and the repair of river banks. There are cases on record in which crops would have been lost but for the assistance given from prison camps, and it may be stated that the conduct and behaviour of the prisoners gave general satisfaction. It was estimated when repatriation started that 400 prisoners would be sent home daily, but the work was seriously delayed by the railway strike.

* * * * *

It has been decided to hold the second National Rat Week between Monday the 29th December and Saturday, the 3rd

The Second Rat Week.

January, by which time it is hoped that the Rats and Mice (Destruction) Bill will have become a law of the land. Many lessons were offered by the first Rat Week to all who were prepared to learn them, and perhaps the most important point to be placed before rural authorities, and kept before them, too, is the tendency of rats to migrate from threatened areas. This habit was very clearly marked in the course of the October campaign. There was a period of rapid destruction, and then people in areas where the Local Authority had failed them found that there were more rats than ever. The truth is that

the vermin had sought the parts in which they were not molested. Long before the date of the first rat week came round this happening had been anticipated, and Local Authorities had been warned that neglect of their duty would add to the troubles of those whose welfare they were appointed to secure. It is to be hoped, indeed it is to be expected, that the action taken against rats in the week beginning on the 29th of this month will be united, and that there will be no Cities of Refuge for the enemy. It has been proved by recent experience that the most effective poisons are preparations of Carbonate of Barium and Red Squills, and it should be clearly understood that the Board of Agriculture do not recommend the use of any Virus. It is to be hoped that there will be a third National Rat Week during February, and that the result of the coming effort, made at a time when reproduction is at its lowest ebb, will be a very real benefit to the health and the pocket of the community.

THE OFFICIAL SEED TESTING STATION.

SECOND ANNUAL REPORT.

SINCE the publication of the last Annual Report of the Seed Testing Station* considerable changes have taken place in relation to the Station and its work. The Station, which was working under somewhat cramped conditions at 72, Victoria Street, Westminster, S.W.1, has now been transferred to 18, Leigham Court Road, Streatham Hill, S.W. 16. These premises provide considerably greater accommodation, while small areas of garden and glass are available, which will enable the Station to undertake lines of work which were previously impossible.

Mr. R. G. Stapledon, to whom the successful establishment of the Station on an efficient basis is so largely due, has resigned the position of Director consequent on his appointment to the Chair of Agricultural Botany at the University of Wales, Aberystwyth.

A brief Interim Report on the work of the Station was published in the issue of this *Journal* for February last. The present Report covers the year from 1st August, 1918, to 31st July, 1919, and is intended to give an outline of the results of tests conducted during that period. It is not proposed, however, to consider the nature of the impurities occurring in

* See this *Journal*, September, 1918, p. 641.

the samples tested in such detail as was done last year. The nature of these impurities does not vary much from year to year, and it does not appear to be necessary for the details to be included in each Annual Report. The data, however, are available, should they be required.

The First Annual Report of the Seed Testing Station covered the period up to 31st July, 1918. During the year ended 31st July, 1919, 23,604 samples were submitted to the Station for testing, exclusive of about 2,000 small packet samples received from the Seed Control Branch of the Board of Agriculture. This total is more than three times that of the season 1917-18, when 7,744 samples were tested, and shows the extent to which the work of the Station has increased. It is not likely that the present season will show a corresponding increase, but it is estimated that at least 30,000 samples will be received.

The following table indicates the sources from which the samples were received. The figures for the previous season are given for comparison:—

TABLE I.

		<i>Relative Increase.</i> <i>Figures for</i> 1917-18. 1918-19. 1917-18 = 100.		
Seed Firms	Number sending samples ..	492	808	164
	„ of samples received	5,676	13,950	246
Farmers, etc.	„ sending samples ..	772	2,467	319
	„ of samples received	1,553	4,541	293
Public Depts.—Number of samples received		515	5,113	993
Total number of samples		7,744	23,604	305

The most gratifying feature of the above table is the increase in the number of farmers who have made use of the Station. In many cases, of course, the farmer had his seed tested in order to obtain figures on which to base a declaration in case of sale. The majority of the farmers' samples, however, consisted of seed which they themselves intended to sow. Several cases came to notice in which farmers acknowledged that as a result of the Board's seed-testing facilities they were saved from sowing bad seed and so incurring a loss on their operations.

A study of the map on p. 871, which has been reproduced from a larger map prepared for the Show of the Royal Agricultural Society, will show that there is no very close relation between the amount of agricultural land in a county and the number of farmers in that county who have sent samples for test. Evidence has been obtained, however, which makes it clear that the use made of the Station by farmers of a particular county, is largely dependent upon the activity in this direction of the County Agricultural Staff. The counties which have

made the most use of the Station are Devon, Stafford, Yorkshire, Lancashire and Lincoln, but in proportion to area Anglesey, Montgomery, Stafford, Devon and Cornwall show the best records. In some counties it would be of value if the importance of seed testing could be brought home to farmers. It is instructive to note that, whereas in Anglesey one farmer per 1,185 acres of land under rotation sent samples to be tested, in Wiltshire only one farmer per 18,092 acres sent samples.

The large increase in the number of samples received from Public Departments is accounted for largely by some 2,000 samples of oats, which were tested for the Board before shipment to France, and by an increased number of "control" samples.

The distribution according to species of the total number of samples tested is shown in Table II. The corresponding figures for last season are given for comparison. It will be noted that the increase is greatest in the case of cereals, pulse and vegetables; in grass and clover samples the increase is relatively small. The explanations for this are several, but the two which have most bearing on the figures are (a) the fact that the Station was not opened until November, 1917, and that consequently much seed corn and stocks of vegetable seed which had been held over were excluded from the previous year's total, and (b) the poor harvest of English clovers in 1918.

The 1918-19 figures show an increase over those for 1917-18 in every case except meadow fescue, and in some cases the increase is tenfold.

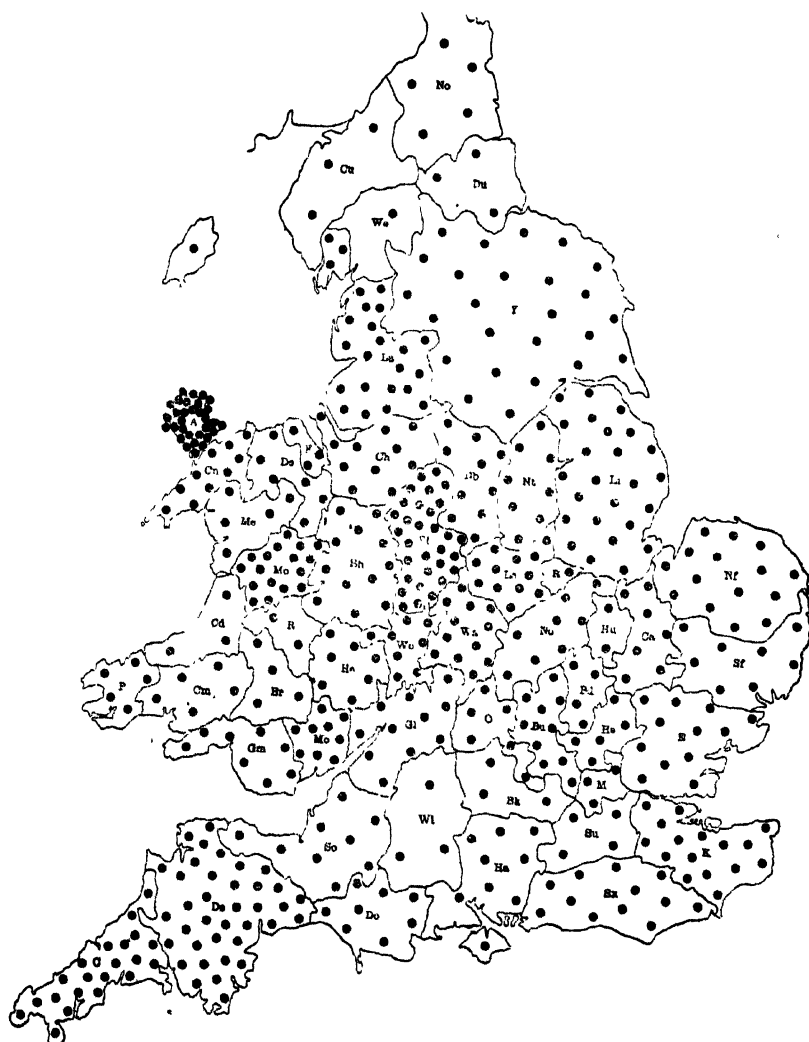
TABLE II.—Showing Number of Samples of different Kinds of Seeds tested.

	1917- 1918.	1918- 1919.		1917- 1918.	1918- 1919.
Cereals—			Clovers—		
Wheat	206	3,729	Red Clover ..	1,249	1,774
Barley	348	977	Alsike	392	460
Oats	1,370	5,207	White Clover ..	313	486
Rye	10	192	Trefoil	294	502
Maize	24	31	Lucerne	78	134
Pulses—			Sainfoin	66	131
Peas	93	942	Crimson Clover ..	38	174
Beans	61	475	Other Legumes ..	6	56
Vetches	77	271	Grasses—		
Roots and Vegetables—			Perennial Rye-grass	347	460
Turnips	323	614	Italian	340	520
Swedes	369	496	Cocksfoot	157	247
Rape	75	113	Timothy	151	174
Kale	73	149	Meadow Fescue ..	77	78
Cabbage	108	490	Crested Dogtail ..	56	78
Other Crucifers ..	44	562	Other Grasses and		
Mangolds	594	1,184	Mixtures	14	70
Beet	52	390			
Onions	145	899	Linseed	92	306
Parsnips	24	206	Forest Trees ..	0	30
Carrots	44	481	Miscellaneous ..	34	18

The distribution of samples through the seed testing year is shown in Table III., and also in the diagram on p. 873.

TABLE III.—*Showing Number of Samples received per Month.*

		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1917-18		—	—	—	276	1,084	1,895
1918-19		436	1,819	2,493	1,624	1,813	2,651
		Feb.	Mar.	Apr.	May.	June.	July.
1917-18		1,944	1,399	695	135	126	190
1918-19 : ..		3,678	4,021	2,213	1,542	908	406



Map showing number of farmers in each county who sent samples for test during the season. Each dot represents five farmers.

It will be noted that the height of the season was about a month later than was the case in 1917-18. February and March were the busiest months, as against January and February in 1917-18. This is in part explained by the bad weather before Christmas, which delayed the threshing out of some of the home-grown seed crops.

CEREALS.

The germination of all the cereals was remarkably good. A low average germination might have been expected, owing to the wet harvest, but, as a matter of fact, in all cases the germination was considerably higher than that of the previous year. The increase is about 10 per cent. in the case of wheat and rye, and about 6 per cent. in the case of barley and oats.

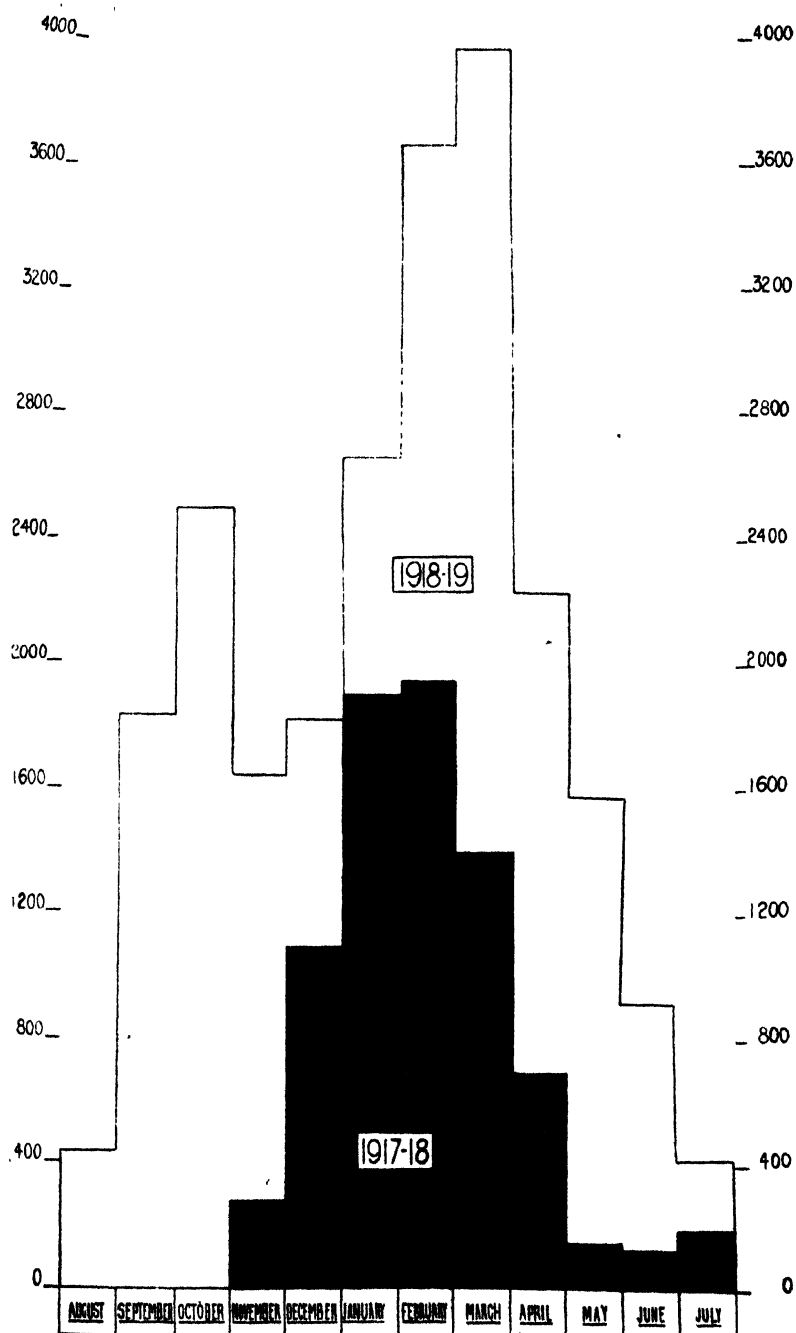
Only just over 5 per cent. of the cereal samples germinated below the minimum figures of germination scheduled in the Testing of Seed Order,* and in quite half of these the growth was only slightly below this figure. In the case of barley, oats and rye, these poor samples were evenly distributed through the testing season, but in the case of wheat it was noticed, as was found last year, that the majority of the bad samples were spring wheats.

TABLE IV.—*Showing the Percentage Germination of Cereals.*

—	Number of Samples included in the Average.	Range of Germination. Per Cent.	Average Germination. Per Cent.		Percentage of Samples Germinating below "Standard." 1918-19.
			1918-19.	1917-18.	
Wheat ..	3,337	100-2	97·3	85·4	3·3
Barley ..	977	100-23	95·7	89·4	6·6
Oats ..	3,357	100-1	95·1	89·5	6·2
Rye ..	191	100-40	96·5	84·8	3·1
Maize ..	31	100-22	81·0	74·9	—

Many freshly-harvested samples showed low germination "as received," but after appropriate treatment a considerably better germination was obtained in most cases. This subject was discussed in an article published in the issue of this *Journal* for July last, and it is unnecessary to go into details in this Report. It may be mentioned, however, that the main facts elicited were that an increased germination frequently occurs

* These "minimum figures of germination" are hereafter referred to as "Standards." This term is an undesirable one, but it has the merit of being brief and is, moreover, in general use by the Seed Trade.



Monthly number of samples of seeds tested at the Seed Testing Station since its establishment, showing increase in season 1918-19 over 1917-18.

when freshly-harvested samples of wheat, barley and rye are subjected to a preliminary drying process—three days at 40 deg. C. being found to be suitable—but that in the case of oats the effect is not so marked, and that a longer period of drying at a lower temperature gives better results.

“Bunted” grains were present in 5·7 per cent. of the wheat samples; the number of samples which were contaminated by “Bunt” spores, however, was very much greater. 2·7 per cent. of the wheat samples contained “Ear Cockles” or “Burnt Corn” (due to the eelworm, *Tylenchus scandem.*), and it was noticed that samples so affected came mainly from the west and south-west of England. Of the barley samples, about 6 per cent. were visibly affected with the spores of one or other of the species of barley smut, the “closed” smut (*Ustilago Hordei*) being the more frequent. 10·5 per cent. of the rye samples contained Ergots (*Claviceps purpurea*).

Comparatively few samples contained excessive amounts of weed seeds, and on the whole the samples were much cleaner than was the case in 1917-18.

PULSE.

The germination of peas was about 8 per cent. lower than in 1917-18, and nearly one-third of the samples tested were below the “Standard.” English-grown seed, in particular, was of low quality, probably owing to the wet harvest. There was, however, very much less damage by beetles than usual, less than 1 per cent. of the samples being visibly attacked by these pests.

On the whole the beans showed higher figures than in the previous season. The germination of field and broad beans was quite satisfactory, and dwarfs averaged 24 per cent. higher than in 1917-18. Scarlet runners, however, were slightly lower. About a quarter of the dwarf and runner samples were below “Standard.” Although there was little beetle attack in peas, it was found to be very bad in beans, no less than 21·7 per cent. of such samples being affected.

Vetches showed a high average figure of germination, but even in this case one-fifth of the samples were below “Standard.”

There were comparatively few pea and bean samples with a purity of less than 97 per cent., but many vetch samples contained large amounts of the seed of the various cereals.

ROOT AND VEGETABLE CROPS.

All cruciferous seeds, with the exception of rape, show an increase upon the 1917-18 figures, varying from 2 per cent. for

cabbage to 6 per cent. for kale. The average germination for rape is 7 per cent. lower than in the previous year. Roughly, about one-third of all crucifer samples showed germination figures below the "Standards." It is interesting to note that the average for the season agrees very closely with the "Standard," except in the case of Brussels sprouts.

Mangolds and sugar beet did not germinate so well as in 1917-18. Garden beet, on the other hand, shows a considerable

TABLE V.—*Showing the Percentage of Germination of Pulses, and Root and Vegetable Crops.*

—	Number of Samples included in the Averages.	Range of Germination. Per Cent.	Average Germination. Per Cent.		Percentage of Samples germinating below "Standard." ("Standard" Figure in Brackets.)
			1918-19.	1917-18.	
Peas ..	942	100-8	78.7	86.7	31.7 (75)
Beans (Field)	74	100-84	98.2	97.11	—
Beans (Broad)	82	100-74	95.3	93.4	4.9 (80)
Beans (Runners)	140	100-0	75.8	80.1	26.4 (65)
Beans (Dwarf)	124	100-11	86.0	62.7	23.4 (80)
Vetches ..	271	100-2	92.7	77.6	20.6 (90)
Turnip ..	614	100-0	88.8	83.7	11.6 (85 Field) (80 Garden)
Swede ..	496	99-20	84.9	79.9	34.6 (85)
Rape ..	113	99-0	83.0	90.2	38.9 (85)
Kale ..	149	98-0	77.4	71.5	35.5 (75)
Cabbage ..	490	99-0	75.8	73.5	31.6 (75)
Brussels Sprouts	88	99-17	84.3	—	22.8 (75)
Broccoli and Cauliflower	317	97-4	75.1	—	26.8 (75 Broc.) (70 Caul.)
Kohl Rabi ..	35	97-50	78.8	—	28.6 (75)
Mangold ..	1,184	228-2	126.7	137.8	35.7 (120)
Beet (Garden)	364	258-0	109.2	84.0	43.4 (100)
Beet (Sugar)	21	192-14	130.1	143.8	—
Parsnip ..	206	95-0	63.8	45.0	19.4 (50)
Carrot ..	481	94-0	64.4	62.8	32.4 (60)
Onion ..	896	99-0	75.2	78.9	21.1 (65)

increase, but this is probably due to the inclusion in the average of a large number of samples of spinach beet. This also explains the high average of 109 per cent. in spite of the fact that over 40 per cent. of the beet samples germinated below the "Standard." (It is found that seeds of spinach beet almost always show a higher germination than do ordinary beet and mangolds.)

The germination of parsnip samples was considerably higher than usual, less than one-fifth of the samples being below "Standard." This is, perhaps, explained by the fact that the high price of parsnip seed in the previous season encouraged growers to devote larger areas to seed, and that the seed merchants were consequently enabled to place on the market only the samples with the highest germination. There is little difference between the germination figures for carrot and onion for these two seasons, although there is some evidence of an improvement in the germination of English onion seed.

GRASSES.

The quality of the grass samples tested during the season was good. In all cases the average germination was higher than in the previous year, and in three species out of six the purity also was higher. It is probable that the increase in germination in the case of rye-grass and meadow fescue is partly due to the more extended use of the Copenhagen "tanks" for the purpose of making germination tests of grasses.

The rye-grasses both show an increase in germination, accompanied by a decrease in purity. The fact that the amount of impurity in Italian rye-grass this season is almost double that found last season is somewhat surprising, but it is probable that the purity figures for 1917-18 were abnormal. Cocksfoot, on the other hand, shows a much higher degree of purity than in 1917-18. This seems to be due to the increase in the number of Danish samples and a decrease in the number of samples of French origin. Partly, also, for the same reason, the germination is 16 per cent. higher than in the previous season.

Timothy and dogtail show little change, but a great improvement is noticed in the quality of the samples of the

TABLE VI.—*Showing Percentage Purity and Germination of Grasses.*

	No. of Samples included in the Averages	Average Percentage of Impurities.		Percentage of Samples containing 1 per cent. or over of Injurious Weeds.		Range of Germination. Per cent.	Average Percentage of Germination.	
		1918-19.	1917-18.	1918-19.	1917-18.		1918-19.	1917-18.
Perennial Rye-grass	445	2.86	2.23	89.0	51.0	97-12	88.7	77.1
Italian Rye-grass	516	2.08	1.19	40.0	33.0	98-40	88.4	75.7
Cocksfoot ..	223	2.88	6.64	5.0	6.0	95-15	78.0	62.7
Timothy ..	168	1.32	1.74	less than 1	1.0	99-0	88.8	85.3
Meadow Fescue ..	74	1.95	3.28	85.0	23.0	99-7	84.5	57.3
Crested Dogtail..	71	2.63	2.05	4.0	6.0	93-8	70.2	66.2

meadow fescue tested. This improvement is due not so much to the excellence of the season's supply of seed as to the large number of samples of old seed that were sent in for test during 1917-18.

CLOVERS AND OTHER LEGUMINOUS HERBS.

Clovers, like grasses, show higher germinations than was the case last season. The purity, however, is lower, except in the case of alsike and white clover. The increase in germination was expected, but the decrease in purity is somewhat difficult of explanation. It has been suggested that a larger proportion of broken seed may have been removed with the other impurities during the tests made this season, but there is no evidence to support this possibility. Probably the reason is merely seasonal variation.

The figures shown for the two seasons, under the heading "Percentage of Samples containing 1 per cent. or over of Injurious Weeds" are not strictly comparable. Since 1917-18, suckling clover has been removed from the list of "injurious weeds" and the cranesbills have been added. Consequently the larger seeded clovers which might be expected to contain *Geranium dissectum*, and white clover, which usually contains a large amount of *Geranium molle*, all show an increase in the percentage of samples containing "injurious weeds." On the other hand, wild white clover shows a considerable decrease owing to the fact that suckling clover is no longer classified as an "injurious weed."

TABLE VII.—Showing Percentage Purity and Germination of Clovers.

	No. of Samples in Average.	Average per cent. of Impurity.		Percentage of Samples with 1 per cent. or over of Injurious Weeds.		Range of Germination.	Average per cent. of Germination.		Average per cent. of Hard Seed.	
		1918-1919.	1917-1918.	1918-1919.	1917-1918.		1918-1919.	1917-1918.	1918-1919.	1917-1918.
Red Clover (all samples)	1,697	4.08	3.40	6.4	.5	99-0	81.1	67.0	4.5	3.8
" (English) ..	365	4.42	3.38	—	—	99-1	72.9	60.9	4.0	3.7
" (French) ..	272	4.70	3.00	—	—	98-37	80.4	87.2	3.3	2.6
" (Italian) ..	102	4.08	—	—	—	98-60	87.8	—	5.1	—
" (Chilian) ..	132	1.88	1.23	—	—	98-26	89.9	90.0	7.2	6.7
" (Canadian) ..	35	1.85	1.41	—	—	98-3	88.5	88.9	5.2	6.9
" (American)	89	1.58	—	—	—	98-73	81.0	—	6.0	—
Alsike Clover ..	345	2.47	4.58	2.9	3.2	99-6	84.0	75.3	7.5	8.3
White Clover ..	393	2.80	9.98	40.6	17.2	99-11	78.5	72.3	7.8	8.0
Wild White Clover ..	75	14.23	16.18	5.3	70.0	92-14	74.0	64.2	12.1	15.0
Lucerne ..	125	2.80	2.01	nil	nil	97-35	87.2	84.9	4.7	6.3
Trefoil ..	456	1.87	1.18	3.1	nil	98-4	87.2	64.2	2.6	1.9
Sainfoin ..	131	2.00	2.01	nil*	nil	95-0	66.3	53.2	—	—
Crimson Clover ..	170	4.19	2.14	8.8	nil	99-1	87.1	81.4	.2	.1

* One sample of sainfoin was received containing over 5 per cent. of burnet.

Among the red clovers the most noticeable feature is the increase of 12 per cent. in the germination of English seed. Seed of foreign origin shows little change in this respect. English, French, and Italian red clovers all contain about twice as much impurity as do the North and South American clovers. American (U.S.A.) red clover shows the highest figure, both for purity and germination.

Alsike and white clover both show a satisfactory increase in germination and purity. Over one hundred samples of mixed alsike and white clover were also tested, with the following results :—

Average content of Alsike	70.9 per cent.	} Total purity, 96.2 per cent.
Average content of White		
Clover	25.3 ..	

The great preponderance of alsike in these mixtures is a fact of some significance when the comparative prices of the two seeds are taken into account. The germination of these mixtures was, on the whole, satisfactory.

Wild white clover appeared to be of higher quality than in the previous season, but large quantities of suckling clover were found in many of the samples. Only in one or two cases was there reason to suspect that any American and English white clover had been added to samples of wild white clover.

Trefoil and lucerne both show a somewhat higher percentage of impurity than in 1917-18; there is, however, also a slight increase in germination.

The germination of sainfoin shows an improvement of 12 per cent. on the figures of the previous year, but the growth cannot be described as satisfactory. One sample was received which contained 8 per cent. of burnet. The amount of impurity in crimson clover is nearly double that found in 1917-18. This increase is probably due to the inclusion of a larger number of samples of French origin in the averages.

In addition to the species mentioned in the Testing of Seeds Order, a number of other leguminous seeds were submitted for test. The more important figures are as follow :—

	No. of Samples.	Purity Per cent.	Germination Per cent.
Birdsfoot Trefoil ..	8	96.4	53.6 plus 32.6 hard seed.
Kidney Vetch ..	10	84.1	75.0 " 2.9 "
Suckling Clover ..	22	97.1	61.3 " 17.5 "

It will be noticed that birdsfoot trefoil and suckling clover contain large quantities of "hard seed." The low percentage of purity of kidney vetch is mainly accounted for by the presence of considerable amounts of *Melilotus* in many of the samples.

Occurrence of Dodder in Clovers.—The occurrence of dodder in the clover samples tested was somewhat similar to that found last season. The following list includes all samples in which at least one seed of dodder was found, whether or not it was present to a notifiable extent :—

Percentage of Samples containing Dodder.

<i>All</i>		<i>Red Clover.</i>					<i>Lucerne.</i>
<i>Samples.</i>	<i>English.</i>	<i>French.</i>	<i>Italian.</i>	<i>Chilian.</i>	<i>Canadian.</i>	<i>U.S.A.</i>	
1918-19 ..	27·3	12·1	31·6	23·5	90·9	20·0	10·1
1917-18 ..	26·8	24·0	19·0	—	82·0	30·0	—
							6·7
							7·0

In addition, dodder was found in five samples of white clover, two samples of crimson clover, one sample of mixed alsike and white clover, and in one sample of wild white clover.

It will be observed that while the percentage of all red clover samples containing dodder remains much the same as in 1917-18, yet English samples were considerably freer from the seed of this parasite. Dodder was, however, more prevalent in French samples, and only 12 out of 132 samples of Chilian red clover were found to be free from its seeds.

Several samples of Chilian red clover contained over 5 per cent. of dodder, whilst one sample described as English contained over 9 per cent. of Chilian dodder, together with an abundance of such seeds as *Amaranthus* and *Lythrum hyssopifolium*. Another sample of an English red clover sent for a "dodder examination" contained upwards of 10 per cent. of European dodder.

The effect of the "dodder latitude" clause of the Testing of Seeds Order is of interest. Though 27·3 per cent. of all red clover samples contained dodder, yet it was only "present to an extent exceeding one seed in 4 oz." in 21·0 per cent. of the samples. In other words, no fewer than 107 samples of red clover, containing dodder, did not contain it to a notifiable extent.

GENERAL SUMMARY.

The study of the foregoing figures and notes suggests the following conclusions :—

(a) In spite of the increase in the number of farmers' samples, it is evident that much more use of the seed-testing facilities provided by the Station might, with advantage, be made by the actual sowers of seed. It is not suggested that reliance cannot be placed upon the declarations given by seed merchants, although it is not undesirable that the farmer should from time to time have check tests made. It is in respect of bulks held over from a previous season that the Station might be able to

provide the farmer with useful information. The grower knows that yearling samples of most agricultural seeds germinate quite satisfactorily if they have been stored under suitable conditions, but he does not appear always to recognise that the conditions under which he has kept a sack of seed may be unsuitable. Slightly damp stores or the presence of mice will very soon cause deterioration which will not in all cases be obvious to the unpractised eye.

(b) On the whole, the germination and purity of the samples tested in 1918-19 were found to be higher than in 1917-18. As the conditions under which the seed tested in 1918-19 were harvested were more unfavourable than those of the preceding year, it is evident that the improvement in the germination of the seeds cannot be due to climatic causes. One factor noticed was that there was much less yearling and over-yearled seed sent for test during the season under review. To what extent this was due to a general shortage in 1918-19 of stocks carried over it is difficult to say. Apart from this factor, however, it seems not unreasonable to suggest that the improvement in the quality of the seed may be due largely to the beneficial effect of the Testing of Seeds Order in checking the sale for sowing of samples of very low grade.

It is not easy to explain the decrease in the purity of many of the grasses and clovers. In some cases it is due to the presence on the market of an increased number of samples of French origin. This, however, is only a partial explanation, and a comparison with the results of several seasons' testing is necessary before such points can be satisfactorily explained.

NOTE.—The present address of the Seed Testing Station is 18, Leigham Court Road, Streatham Hill, S.W. 16, and all samples and communications relating to seed testing matters should be addressed to the Director, at this address.

Particulars as to size of sample required and as to fees payable are set forth in

(a) *Food Production Leaflet No. 47* (for the use of farmers). This also contains the text of the Testing of Seeds Order. It may be obtained on application to the Secretary, Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1.

(b) *Notice to Seedsmen* (S.T. 8), obtainable from the Seed Testing Station.

THE EXTENSION OF EDUCATION TO THE AMERICAN FARMER.

J. G. MERRISON.

AMONG the many institutions, both state and private, which have been formed in the United States and Canada, with the object of bringing to the farmer the best scientific knowledge, and of educating him in the most economical farming practice, a private corporation occupies a prominent place. To the English mind it may appear almost paradoxical that an agricultural machinery manufacturing company should engage in widespread educational work and propaganda, a large part of which has no direct connection with the business of selling implements. In America, however, the International Harvester Company supplies valuable educational information to the farmers of the United States, and its publications, charts and slides are to be found in all agricultural education institutions throughout the country. Its methods are imitated not only by public bodies but by other agricultural machinery firms, and a description of the nature of its work and the system pursued may be of value in England.

The organisation of the Extension Department (as it is named) of the International Harvester Company is twofold :—

1. An institute to collect facts and ideas of value to agriculturists ;
2. A staff to distribute to the farmer, in the form which best appeals to him, the body of accurate knowledge already available in scientific institutions, which has been proved to be sound and can be applied in practice. Any part or branch of knowledge which has an academic as contrasted with a practical value is deliberately passed over.

The objects of the Extension Department are to educate farmers to a higher standard of farming by making immediately obtainable a knowledge of the most recent and approved methods ; to lighten the burden of women on the farm ; and generally to make farm life attractive. The work depends for its success upon the co-operation of the people it is designed to help, and this fact has largely determined its scope and form, as well as provided a guarantee for its success.

The Extension Department depends for its facts and ideas upon the research and educational institutions of America : any research work upon agricultural machinery conducted by the International Harvester Company itself is done independently

of its own Extension Department. The Extension Department satisfies itself that any proposals which it advocates are of practical value, and the demonstration farms, to which reference is made below, would enable it to discover any error of judgment.

The methods pursued in conducting educational and propaganda work may be divided under four heads: (1) The educational "campaign," with its three subdivisions, (a) the campaign proper, (b) the demonstration truck, and (c) the demonstration farm; (2) Literature distribution; (3) Visual method; (4) "Safe Farming" newspaper service.

I. The Educational Campaign.—(a) *The Campaign Proper.*—The nature of a campaign conducted by the International Harvester Company is best described by taking a typical instance on a large scale. The agricultural position of Arkansas in 1913 was such that a one-crop system of growing cotton for 40 years had placed the State at the mercy of the North and East, both in buying and selling. The cotton crop in 1913 was sold for \$63,000,000* (£13,125,000). This amount and an additional \$12,000,000 (£2,500,000) were sent out of the State to buy foodstuffs which should have been produced in Arkansas.

In 1914 prominent interests in the State invited Professor P. G. Holden, Director of the Extension Department of the International Harvester Company, to visit Arkansas in order to direct a state-wide agricultural campaign. The object of the campaign was to impress upon the farming community the necessity of making Arkansas farms feed Arkansas people. Farmers were urged to have something to sell every week in the year and keep the proceeds of the cotton crop at home; to get rid of the cattle tick; to have more pastures; to rear cattle, pigs and poultry; to have a garden for every home; and to have good schools and good roads.

Professor Holden and a staff of 30 practical men began work in November, 1914. The campaign extended over a period of 35 days and covered the entire cotton belt of the State (Fig. 1). The following summary shows the amount of work done:—

Number of counties in which meetings were held ..	49
Total number of meetings (places of meeting indicated by a star on the map)	1,324
Attendance	130,000
Items of literature distributed (no advertising matter)	362,000
Miles travelled—	
Railway	20,858
Motor and buggy	81,115
Speakers and organisers engaged in the work ..	61

* At \$1 = 4s. 2d.

ARKANSAS BEGINS STATE-WIDE EXTENSION WORK IN AGRICULTURE

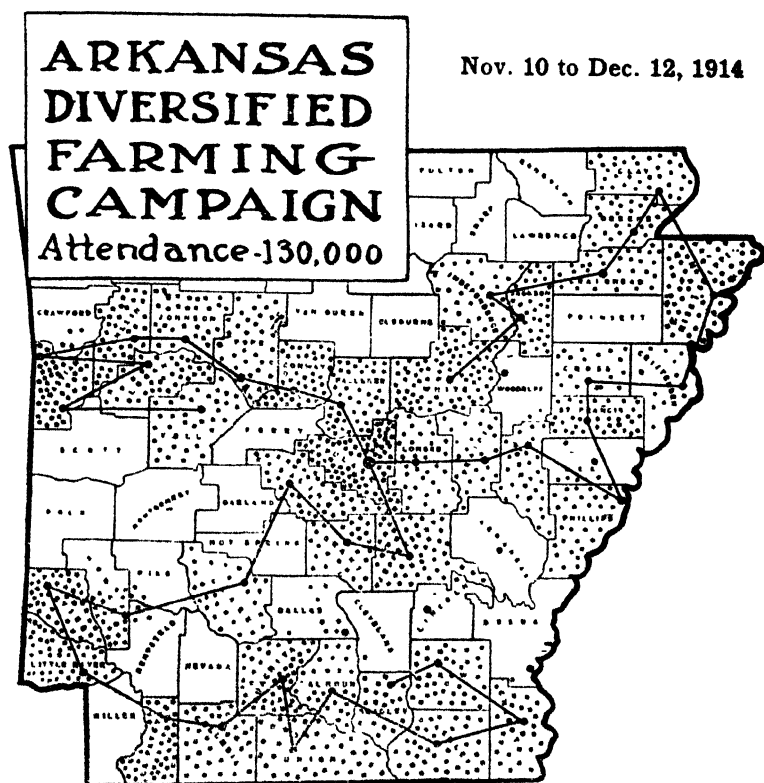


FIG. 1.—Sketch map of Arkansas showing counties and towns visited and meetings held

The immediate effect of the campaign was remarkable, and the statements in an article in the *Little Rock Arkansas Democrat*, of which an extract is given below, may be taken as accurate, based as they are upon estimates made by the United States Department of Agriculture :—

“ With a short crop of cotton and a long crop of grain, fruits, vegetables, the farmers of Arkansas are approximately twenty million dollars better off this year than last. This estimate is made from the 8th November Crop Bulletin of the Weather Bureau, United States Department of Agriculture—not upon the authority or suggestion of any one who was interested in the material aspects of the Arkansas Profitable Farming Campaign.

“ According to this estimate, Arkansas in 1914 produced 1,016,170 bales of cotton, worth about \$35,500,000 at 6 cents a pound.

“ Arkansas in 1915, according to the 25th September estimates, produced approximately 800,000 bales of cotton, and the price to the producer on that date was 12.4 cents a pound. The total value of the 1915 crop is estimated to have been worth \$54,000,000 on 1st November.

“ There is an increase in 1915 over 1914 of more than 20,000,000 bush. in the corn crop* ; nearly half a million bush. of wheat ; two and a quarter million more bush. of oats ; and over one and a quarter bush of potatoes.

“ The total value of these products to the State is estimated by the Weather Bureau forces at about \$66,000,000, while the estimate of money actually received last year was about \$46,000,000.

“ Out of seventy-five counties in Arkansas all except eighteen have declared for Tick Eradication.

“ Arkansas this year came nearer feeding herself than at any time in her history. The railroads report a great increase in grain haulage.

“ Corn, wheat and oats are growing in fields where cotton has occupied the soil for the past 30 years. There is no doubt that the Profitable Farming Campaign was largely, if not solely, responsible for the change.”†

(b) *Demonstration Trucks* are used in connection with a large-scale campaign, and are also of use in bringing home to a locality a lesson upon some precise point which is of special importance to that particular place. A demonstration truck is a large lorry loaded with machinery selected to illustrate the particular lesson it desires to convey. A man is sent in advance to arrange for an audience and to secure suitable land and the co-operation of people necessary to stage demonstrations, so as to impress the object lessons of the campaign more forcibly. The method of demonstration is to contrast the old and new

* Maize.

† Possibly the War also had an influence in effecting the change.—*Editor*.

methods of carrying out an operation; for example, in Mississippi a negro with one mule and a small one-furrow plough was shown working alongside a man driving four horses on a two-furrow self-lift sulky plough.

(c) *Demonstration Farms.*—The International Harvester Company has established demonstration farms throughout the United States. These farms are used largely to demonstrate the fact that it is only through the cultivation of a wide range of crops and the raising of live stock that the United States will remain a great rich country and have a strong, vigorous people. In places where a one-crop system has prevailed for any length of time the soil has become impoverished, adversely affecting the people on the farms.

As an instance of this branch of work may be taken Brookhaven Farm (Mississippi), 160 acres in extent, and situated in the heart of the cotton country. When purchased seven years ago this farm was in a very derelict condition, with red gulleys on every hill-side, bottom lands under water, stumps dotted over the fields, and no pasture. The farm was suffering generally from all the evils of the one-crop system of growing cotton alone. It has now a very different appearance. The stumps have been pulled; no land lies under water; the gulleys have been removed; and permanent pasture occupies these spots. More than half the land is in permanent pasture, which is stocked to its capacity with Jersey cows (Fig. 2).

In co-operation with the State Agricultural Organisers and the railways, farmers' excursions to the Company's demonstration farms are organised. For these excursions the Company has an efficient force of lecturers, who guide the farmers over the farms, and point out to them all the advantages which are to be gained by the crop rotation and diversified farming methods. One very important point to be remarked is that the lecturers and demonstrators do not go out to preach the ideal in agriculture, but to meet conditions as they are found.

2. *Literature Distribution.*—The books and bulletins published by the Extension Department cover a very wide range of subjects, dealing not only with matters directly connected with increased production but with all aspects of farm life. The ultimate object is so to educate the farmer's household as to lift the daily life of the home above drudgery and mean worries. The following are a few of the subjects dealt with, and illustrate the variety of matters covered:—

Every Farm is a Factory.
Grow a Vegetable Garden.
Alfalfa on every Farm.
Helps for Wash Day.
A Good Home (provides comfort,
profit and pleasure).
Fly Catechism.

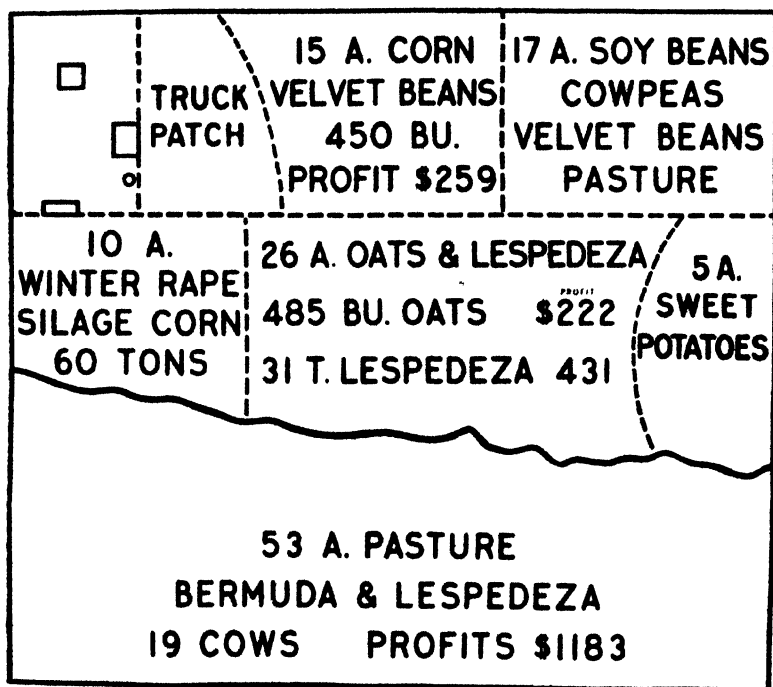
Diversified Farming.
Seed Corn.
A Silo on every Farm.
Home Canning.
A Disc Harrow.
A Pig for every Boy.

This literature is distributed through such people as bankers and seed merchants who are interested enough to see that it reaches the farmer.* No advertising matter of the Company is printed upon any of these publications, but the back of a bulletin is left blank, for use as an advertisement page by the person who undertakes the distribution. The books cost from one cent for eight page pamphlets to fifty cents for 150-page books. No profit is made by the Company, but the distributor is charged with the cost of publication. If the distributor, who is the only advertiser, is to get any return for his money he must see that the books reach the proper people. This ensures that very few publications of the International Harvester Company are wasted. The books and pamphlets are published in a form most attractive to the public for which they are intended; that is, farmers with no special technical equipment, and the object is to guide them on right principles and to supply them at least with the rudiments of scientific agriculture. As an example may be taken the publication entitled "Seed Corn—Do you know that it will grow?" the cover of which is here reproduced (Fig. 3). The object of this pamphlet, which is profusely illustrated, is to instruct the farmer in the selection of seed and the methods to be employed in testing. The motto of the pamphlet is, "Test—don't guess," and the illustrated letterpress drives this lesson home. The illustration reproduced as Fig. 4 will make clear the method employed. Any farmer studying the plates of this pamphlet can see at a glance which ears of corn to discard.

3. **Visual Method.**—The International Harvester Company has compiled in the form of lectures (illustrated by charts and lantern slides) the results of the most practical experiments and investigations conducted in America by Colleges and Experiment Stations on soils, crops, live stock, weeds and insects. In addition, following the lines of the other propaganda work of the Company, the Company has compiled lectures on home

* Literature specially suited for schools is also distributed free of charge.

BROOKHAVEN I H C FARM 1913



160 ACRES TOTAL PROFITS \$2095

⊕ 6-DF

FIG. 2.—Chart of Brookhaven Farm, Mississippi.

economics and other subjects which directly concern the farm and home. The following list shows the range of subjects treated :—

Corn is King.	Fight the Fly.
Alfalfa on every Farm.	More Forward Movement in Education.
Dairying.	Diversified Farming for the South.
Greater Profits from the Oat Crops.	Home Canning.
Make more from your Farm Poultry.	Developments in Agriculture.
Weeds mean Waste.	
Home Economics and Sanitation	

The charts are the framework around which the lecturer builds his story : they are used on the same principle as are newspaper paragraph heads, to impress the reader with the main points of the subject discussed.

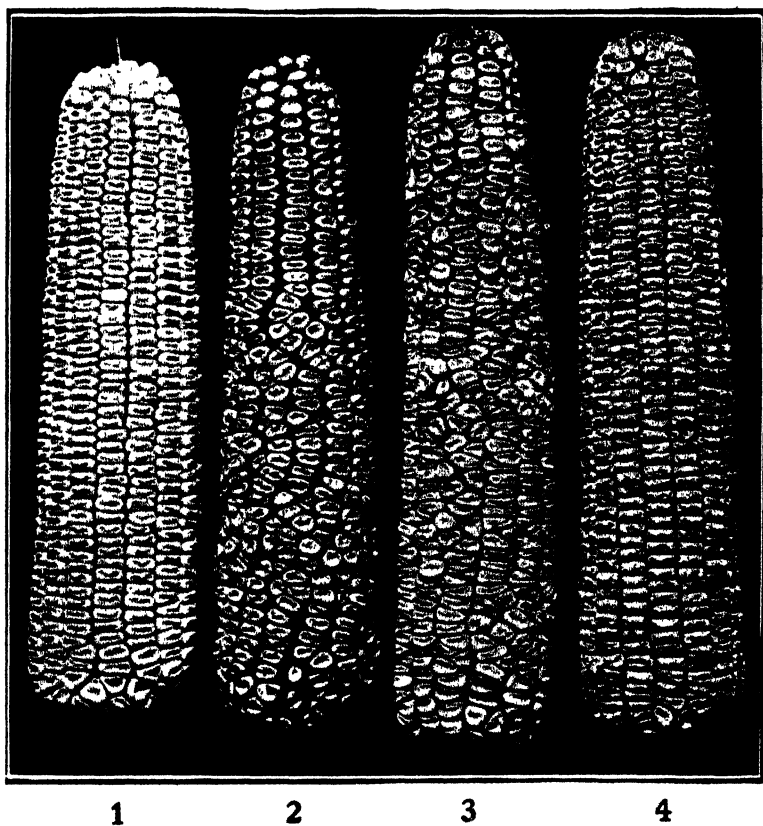
The charts are 70 in. long by 63 in. wide, and may be read at a distance of 100 ft. or more : the six which are here reproduced in miniature (Fig. 5) illustrate both the variety of the subjects treated and the method of appeal.* Lecture books giving in brief form the story of each chart and slide, together with the charts and slides themselves, are supplied to Community Organisations, College and School Authorities, and County Organisers, who are required only to meet conveyance charges on the charts and slides to and from Chicago, and to supply a report of the meeting. By this method the Department secures the co-operation of the greatest number of people, and it is interesting to note that as a result of this form of appeal 3,756,000 people attended 39,721 lantern-slide and chart meetings held between January, 1913, and January, 1917.

4. **" Safe Farming " Newspaper Service.**— Professor P. G. Holden, of the Extension Department, edits a weekly newspaper service dealing with the same subjects as are treated in the Company's literature and lectures. The articles are sent in galley proof and matrix to large newspapers that run an agricultural column or page. These newspapers pay the cost of the matrix and printed articles, but the International Harvester Company derives no direct profit. The newspapers co-operating with the International Harvester Company in this work cover every State in the Union, and the number of readers reached through this service is estimated at eight millions per year.

* It may be mentioned that the method of weed eradication advocated in chart No. 6 is of doubtful advantage, and certainly could not be recommended for this country.

Select Ears with Kernels of Uniform Size and Shape

Ears Two and Three Should Be Discarded



Irregular Kernels. In selecting seed ears Nos. 2 and 3 should be discarded as no planter will drop a uniform number of these kernels per hill.

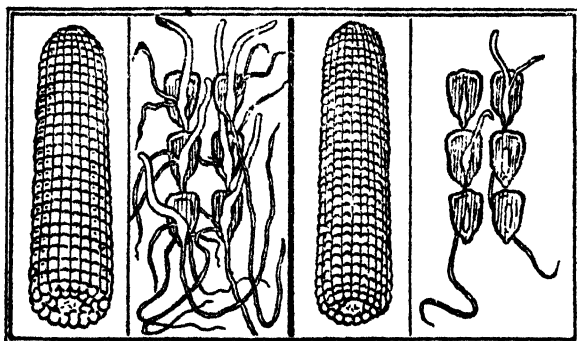
Ears Nos. 1 and 4 have kernels of uniform shape and size, and when the butts and tips were shelled off the planter dropped three kernels to a hill in ninety-three to ninety-five times out of every 100 tests, while ear No. 2 tested 71-3's, 19-2's, 6-1's, and 1-3's.

FIG. 1. A page from an I.H.C. educational pamphlet.

SEED CORN

Do You Know That
It Will Grow?

By
P. G. Holden
&
J. E. Waggoner



Test - Don't Guess

FIG. 3.—Cover of I.H.C. educational pamphlet.

GIVE TO THE HOME THE BEST YOU HAVE

WHAT IS HOME TO YOU
IS IT CATTLE AND HOUSES
AND MONEY AND LANDS
OH WHERE IS MY WANDERING
BOY TONIGHT

LET FATHER MOTHER BOYS AND GIRLS

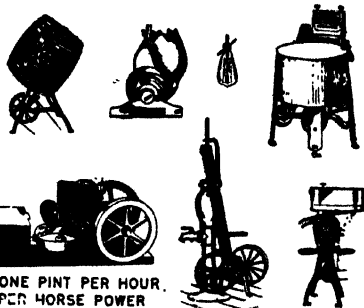
BE COMPANIONS PARTNERS PLAN WORK
PLEASURE

LET EACH BOY AND GIRL OWN SOMETHING
ALL WORK AND NO PLAY MAKES
JACK A DULL BOY

THERE IS NO PLACE LIKE HOME

© H. B. 13

WIFE SAVER LIFE SAVER

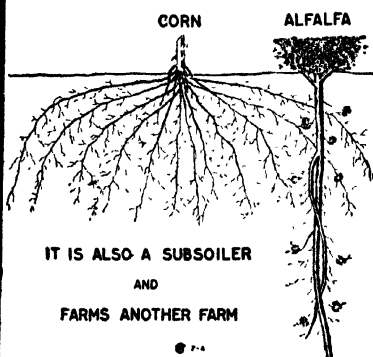


ONE PINT PER HOUR.
PER HORSE POWER

WHY SHOULD WE MAKE MOTHER
DO THE WORK

© H. B. 4

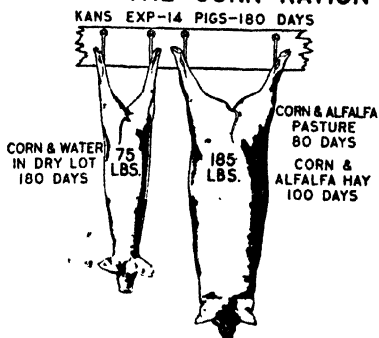
ALFALFA A DROUTH RESISTER



IT IS ALSO A SUBSOILER
AND
FARMS ANOTHER FARM

© F. 4

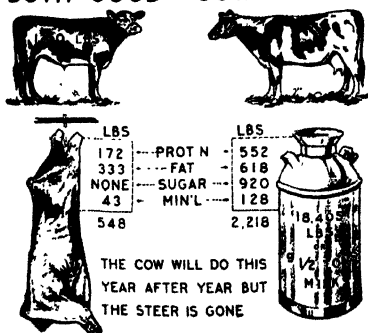
ALFALFA BALANCES THE CORN RATION



KANS BUL 192

© H. B. 10

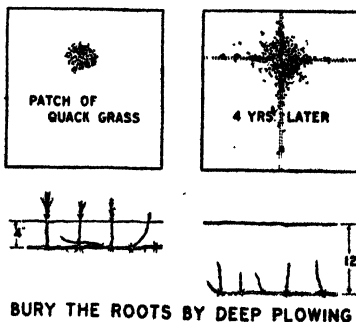
FOOD VALUES BOTH GOOD COW BETTER



THE COW WILL DO THIS
YEAR AFTER YEAR BUT
THE STEER IS GONE

© J. 10

DON'T SPREAD QUACK GRASS WITH PLOW, DISK, CULTIVATOR



© W. 10

FIG. 5.—Charts 1 and 2, Home Education. Charts 3 and 4, To illustrate advantages of diversified farming. Chart 5, To illustrate advantages of milk and beef. Chart 6, To illustrate method of weed destruction.

The question naturally arises as to what advantage the International Harvester Company derives from this educational work, which, in order to be effective, has to be free from advertisement. Doubtless the good work which the firm does enhances its reputation in public opinion, and this is as effective as an advertisement. Better farming means a better financial position for the farmer and a greater demand for improved machinery, and although these factors may assist the rivals of the International Harvester Company as well, the position of the Company is so strong that it must reap the chief benefit. Naturally enough, in the end the expenditure has to be justified by the profit-and-loss account, but it is a matter for remark by British manufacturers, and perhaps by British public departments, that purely educational work on a large scale will "pay" a profit-making business.

THE DETERMINATION OF FARM COSTS.

SIR JOHN KEANE.

THERE are indications that the subject of farm accounting is about to receive the attention that its importance deserves. It may, therefore, be of interest to readers of this *Journal* to see the actual results of one who has been working at the problem for some years. Subject to certain modifications necessitated by local conditions, the accounts published below (pp. 897-906) are prepared on the lines laid down by Mr. Orwin in his book "The Determination of Farming Costs,"* and for a further study those interested are referred to this work. Experience shows that, granted a general knowledge of accounting principles, farm accounts up to a point are straightforward. There are, however, points on which the expert commercial accountant is liable either to go astray or become very involved unless he works in close association with the practical farmer.

Before proceeding to examine in detail the actual accounts dealt with in this article, it is proposed to discuss the special difficulties encountered.

* Published by the Clarendon Press, Oxford.

Difficulties encountered.—A true account should include all charges, or clearly explain which have been omitted. In the present accounts no charges are made for interest on capital nor for the services and expenses of the proprietor. Interest on capital is omitted because it is regarded as a charge on profits rather than on production. No proprietor's salary is charged, because in this case—as in the case of many farm owners—the proprietor only devotes part of his time to farm work. The better plan, therefore, appears to be to omit such charges in all cases and expect varying degrees of profit according to the time the proprietor devotes to the work. This excludes an item which must always be variable and, as such, is bound to affect the value of the accounts for purposes of comparison. In the case of the proprietor's expenses—chiefly those for travelling on farm business—these have not hitherto been charged, but will be included in future. The sum may not be large, but it is certainly a charge against production.

The best manner of apportioning grazing charges has presented some difficulty. To keep a record of the time spent by different classes of stock on various kinds of pasture involves much recording, and the results in the end hardly attain scientific accuracy. The method here employed is to distribute the total pasture charges at the end of the accounting year *pro rata* to the capital value of the various classes of stock. This at least has the merit of simplicity, and where no high-priced pedigree stock is kept appears to be a fair division. An alternative method would be to distribute on a basis of live weight, but the data for this have not been readily available.

How best to allocate "overhead charges" is another debatable point. The method here followed is to place them all, in the first instance, upon the land, and thus include them in the cost of the crops or pasture. Admittedly, in the case of charges for special buildings and implements, direct allocation would be more accurate, but the effect of this has been examined, and the difference is found to be surprisingly small.

It is natural to expect that some figures in the following accounts will excite criticism. Absolute accuracy is not claimed; it takes years to arrive at the best method of apportionment between departments. So far as cash transactions are concerned, however, the figures are given with confidence. In respect of quantities equal confidence is not possible, as weighings have often to be done hurriedly in busy times, and approximations have sometimes to be accepted. Table XVI.

is used to bring together information not obtainable from cash transactions. It is prepared by the bailiff, rendered weekly, and can be checked while recollection is fresh.

Before adopting the present form of accounts the system of keeping a separate account for each field was considered, but was rejected as involving too much book-keeping for the practical farmer. The aim has been, not to produce partial accounts of extreme accuracy, but complete accounts of approximate accuracy kept in a way the farmer can understand and imitate, and which will help him to control his employees and to see at a glance the economy of his farm.

It is now proposed to examine in detail the various accounts.

Cultivation Accounts.—One uniform table has been adopted for all cultivation accounts. Manual labour is extracted from the time sheets. Horse labour is charged at the close of the accounting year on the basis of cost per working day (see Table XII.). In the case of manures three-fourths of the cost is charged direct to the crop and the balance distributed over the remaining crops. This method is not scientific, but it claims to be a practical approximation. Taking now the crops in detail:—

- (a) *Oats*.—Table I.—This is the principal corn crop. The low cost of cultivation per acre in 1915-16 is due to double cropping of the land and reduced charges for on-costs. In spite of the reduced cost, however, owing to the low yield, the cost per unit of produce is higher than in any other year. It should be noted that in the case of all grain crops one-seventh of the total cost of cultivation is deducted for straw before calculating the cost per unit of the grain.
- (b) *Barley*.—Table II.—The fairly uniform cost of cultivation may be noted.
- (c) *Wheat*.—Table III.—In spite of the small area, these figures are included. The soil on this land does not suit wheat, and it was grown only as a war measure.
- (d) *Oats and Vetches*.—Table IV.—Some of this crop is made into hay, more is fed green, and it is impossible to give any yield figures. For the same reason it is difficult to charge satisfactorily the crop to the stock that consume it. The method adopted is that of charging on a ration basis, taking a full-grown beast as a ration, and equivalents in the case of smaller animals. Generally it is found that, in spite of the high feeding value claimed for this crop, it is difficult to assess its value in relation to any accepted standards.

- (e) *Catch Crops*.—Table V.—These crops are principally rape and hardy green turnips. The same difficulties in determining yields and cultivation charges arise as in the case of oats and vetches. The low cost of cultivation is of interest.
- (f) *Mangolds*.—Table VI.—The yields are low and variable, but are due to ordinary farming vicissitudes. The normal practice is to weigh one cartload and keep tally of the number of loads.
- (g) *Potatoes*.—Table VII.—The yields are low, but there is no reason to doubt their approximate correctness. The yield figures are taken from the actual issues from the pits. The low yield in 1915-16 is due to the large quantity of badly-diseased tubers that could not even be fed to stock.

Live Stock Accounts.—One common form has been adopted for all classes of stock. The object has been to ascertain the cost per stock day and per unit of live-weight increase. It has not, up to the present, been found possible to obtain reliable live-weight figures, but it is hoped to have them from this year onwards. The object of the live-weight particulars is to discount, so far as possible, "dealing" profits, which figure so largely on some farms. It might be quite possible for live-weight increases to cost more than market price and yet to show a profit by successful dealing.

All home-grown food is charged at cost price.

Examining the accounts in detail:—

- (a) *Store Cattle*.—Table VIII.—In future years it is hoped to keep store cattle and calf accounts separate.
- (b) *Pigs*.—Table IX.—The large proportion of home-grown food consumed may be noted. The wide variation in the cost per "pig day" between the years 1915-16 and 1916-17 cannot be explained. In future years the cause of such variations will be examined at the closing of the account. During the War this has not been possible.
- (c) *Sheep*.—Table X.—The average per sheep day over four years works out at $\cdot 38d$. In calculating stock days two lambs are taken as the equivalent of one sheep.

Dairy Account.—Table XI.—These figures may excite criticism, but they are given with no little confidence. The low

cost per gallon is mainly due to the large consumption of home-grown food, which is charged at cost.

Horse Account.—Table XII.—The uniform cost per working day and the increased working efficiency are items of interest. No depreciation is charged to this account, the policy being to sell off old horses from time to time and replace them by young ones, thus keeping the average age constant. This account is a good illustration of the value of cost accounts for the purpose of control.

Allocation of On-costs.—Table XIII.—The figures for one year only, 1917-18, are given; other years follow the same model. Up to the present on-costs have been charged against crops on the basis of actual acreage. This method, however, appears to saddle pasture with an undue share in respect of supervision and implements, and so from 1918-19 onwards the acreage of pasture will be taken at one-half of its actual extent in distributing these charges. Other items will continue to be charged on actual acreage.

Analysis of Profits and Losses.—Table XIV.—Valuations are made at about 20 per cent. below market price and on 1st June, when stocks of grain are low. In the case of stock cattle and pigs the prices are based on live weights. Growing crops and implements are taken at book value, the latter being depreciated 10 per cent. annually. Capital is taken to be the excess of assets over liabilities, and the interest over the past five years amounts to 12.6 per cent. per annum. The profit earned on the various classes of stock is calculated on the average of their capital value at the beginning and end of each account year. This method does not claim to be scientific, but it gives certain information of value. The loss on the dairy for three years, in spite of the low cost of milk production, is attributed to the large amount of butter made and the smaller quantity of milk retailed. In 1918-19 cheese-making was begun and larger quantities of milk retailed. The profits on poultry are startling, but it must be remembered that these stock pick up the bulk of their food, which would otherwise be wasted and for which no charge can be made.

Analysis of Manual and Horse Labour.—Table XV.—This account illustrates the upward trend of manual labour, and reflects the increased efficiency in the management of horse labour.

General Deductions.—Such deductions special to the farm as may be drawn from the accounts given could not be appreciated without a knowledge of the actual farm and its special

conditions. There are at the same time some general considerations of interest that present themselves. Correct farm accounts greatly assist control and supervision. They reveal tendencies and afford data for comparison, and so give a sense of proportion and perspective, which is apt to be lost sight of in the rush and detail of daily routine.

A knowledge of farming costs will be of immense value to farmers and to the Government in fixing prices and meeting the demands of labour. In this respect one isolated effort like the present is, of course, of little service. What is required are several accounts from different classes of farms, covering a number of years. The formation of some organisation for preparing such accounts deserves earnest attention.* The most the present effort can hope for is to serve as a stimulus and example.

While it is desirable to leave individuals as free a hand as possible in the form and preparation of these accounts, it is none the less necessary to adopt uniform methods in respect of valuations, allocation of on-costs, and such matters; otherwise the results will be of little value for the purpose of comparison, and much misdirected criticism will arise.

In attempting to draw deductions from farm accounts it must not be forgotten that the economy of a farm is a balanced structure, and it may not be possible to increase one activity which pays well at the expense of another that pays less well. For instance, on the farm in question sheep in large numbers do not thrive, and an increase in pigs would necessitate the purchase of expensive foods.

It is naturally impossible to supply in this article all the information which some students of this subject may desire. The writer hopes that any who require further particulars or who wish to offer criticisms or suggestions will communicate with him privately at his address at Cappoquin, Co. Waterford.

* In this connection readers interested in the subject of farm book-keeping are invited to communicate with the Director of Agricultural Costing, 5 Waterloo Place, London, S.W. 1, who is collecting data on farm costs. Literature on farm book-keeping will be sent free of charge on application to this address.—*Editor*.

CAPPOQUIN ESTATE HOME FARM.—ANALYSIS OF COST.*

Table I.

GRAIN AND ROOT CROPS.—*Oats*.

Year.	Acreage.	—	Labour.		Manure.		Seed.	Fixed Charges.		Total Cost.	Cost per Acre.	Total Yield.	Yield per Acre.	Cost per Unit.
			Manual.	Horse.	Artificial.	F.Y.M.		Rent and Rates.	Other Charges.					
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1914-15 ..	57.5	Amount % of (10)	£ 59 12.8	57 12.4	97 21	45 9.7	55 11.9	75 16.3	73 15.9	461	8	T. C. q. 40 8 3	T. C. q. 0 14 0	9.8s. per cwt.
1915-16 ..	58	Amount % of (10)	£ 57 23.3	27 11	35 14.3	10 4.1	46 15.7	36 14.7	34 13.9	245	4.2	20 9 0	0 7 0	10.25s. per cwt.
1916-17 ..	61.5	Amount % of (10)	£ 58 17.7	58 17.7	28 8.5	18 5.5	74 22.5	55 16.8	37 11.3	328	5.3	31 11 3	0 10 1	8.9s. per cwt.
1917-18 ..	74.5	Amount % of (10)	£ 126 28	67 14.9	32 7.1	32 7.1	56 12.5	82 18.3	55 12.1	450	6	44 2 3	0 11 3	8.9s. per cwt.
1918-19 ..	14	Amount % of (10)	£ 128.7 21.7	70.4 11.9	61.8 10.4	20.1 3.4	63.3 10.7	110.7 18.7	137.5 23.2	593	6.7	78 6 1	0 17 2	6.5s. per cwt.

Table II.

GRAIN AND ROOT CROPS.—*Barley*.

1914-15 ..	10	Amount % of (10)	£ 9 15.0	12 20.0	9 15.0	4 6.7	13 21.6	7 11.7	6 10	60	6	not available.		
1915-16 ..	8	Amount % of (10)	£ 12.2 24.9	9.2 18.8	7 14.3	2 4.1	3.7 7.5	8 16.3	6.9 14.1	49	6.1	4 0 2	0 10 0	10.4s. per cwt.
1916-17 ..	12.25	Amount % of (10)	£ 20.5 23.6	12.5 14.4	7.6 8.7	4.8 5.5	16 18.4	15.3 17.5	10.3 11.9	87	7	9 18 2	0 16 1	7.4s. per cwt.
1917-18 ..	13.5	Amount % of (10)	£ 25 32.9	7.6 10.	5.5 7.2	5.8 7.6	7.4 9.8	14.4 18.9	10.3 13.6	76	5.7	6 16 0	0 10 0	9.6s. per cwt.
1918-19 ..	14	Amount % of (10)	£ 22.4 28.2	10.2 10.1	9.5 9.4	3.1 3.1	19.4 19.2	17 16.8	19.4 19.2	101	7.2	11 1 0	0 15 3	7.3s. per cwt.

* All cash statements given in the tables have been simplified for purposes of printing by taking the figures to the nearest shilling or pound sterling as the case may be.

Table III.

GRAIN AND ROOT CROPS.—*Wheat.*

Year.	Acreage.	—	Labour.		Manure.		Seed.	Fixed Charges.		Total Cost.	Cost Acre.	Total Yield.	Yield per Acre.	Cost per Unit.
			Manual.	Horse.	Artificial.	F.Y.M.		Rent and Rates.	Other Charges.						T. c. q.	T. c. q.
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1915-16 ..	6.5	Amount % of (10)	£ 4.3 12.6	4 11.8	5.3 15.6	1.6 4.7	7.8 22.9	6 17.7	5 14.7	34	5.2	T. c. q. 2 3 0	T. c. q. 0 6 2	13.75. per cwt.
1916-17 ..	6	Amount % of (10)	£ 6 10.6	3.2 5.5	2.7 6.4	2.3 3.9	30.2 52.3	7.5 13.2	4.5 8.3	57.7	9.6	3 14 1	0 12 1	13.45. per cwt.
1917-18 ..	14	Amount % of (10)	£ 24.3 24.3	24.1 24.1	5.7 5.7	6.1 6.1	14.7 14.7	14.9 14.9	10.2 10.2	100	7.2	9 0 0	0 12 3	9.75. per cwt.
1918-19 ..	16	Amount % of (10)	£ 26.1 24.2	12.8 11.3	10.9 7.4	3.5 3	17 14.6	10.5 16.8	21.4 21	116.2	7.2	10 13 2	0 13 1	9.35. per cwt.

Table IV.

GRAIN AND ROOT CROPS.—*Oats and Vetches.*

1915-16 ..	71.5	Amount % of (10)	£ 72.4 .. 14.8	67.3 13.7	70.5 14.4	20.9 4.3	116.3 23.7	78.1 15.9	61.5 13.2	490	6.8	—	—	—
1916-17 ..	84	Amount % of (10)	£ 26.9 .. 7.4	47.2 13.7	35.3 9.7	22.3 6.1	114.2 31.5	71.6 16.7	45.5 12.6	363	4.3	—	—	—
1917-18 ..	31	Amount % of (10)	£ 24.1 .. 22.5	33.8 17.6	12.3 6.7	13.3 6.9	51 26.6	33 17.2	24 12.5	192	6.2	—	—	—
1918-19 ..	34	Amount % of (10)	£ 41.8 .. 18.1	44.5 19.3	23.1 10	7.5 3.2	38 16.4	11.4 17.9	35 15.1	231.3	6.8	—	—	—

Table V.

GRAIN AND ROOT CROPS.—*Catch Crops.*

Year.	Acreage. (2)	Amount % of (10)	Labour.		Manure.		Seed.	Fixed Charges.		Total Cost.	Cost per Acre. (11)	Yield per Acre. (13)	Cost per Unit. (14)
			Manual. (3)	Horse. (4)	Artificial. (5)	F.Y.M. (6)		Rent and Rates. (8)	Other Charges. (9)				
1915-16 ..	58	Amount % of (10)	£ 18.9 7.6	26.7 10.8	53.5 21.6	15.8 6.4	24.6 9.9	50.4 23.9	49.1 19.8	248	4.3	—	—
1916-17 ..	80.5	Amount % of (10)	£ 21.5 6.9	46.6 14.9	45.1 14.5	28.1 9	22.6 7.2	96.8 39.1	57.3 18.4	312	3.9	—	—
1917-18 ..	31.5	Amount % of (10)	£ 13.6 11.1	14.6 11.8	13. 10.6	13.6 11.1	20.2 8.3	33.6 27.3	24.4 19.8	123	3.9	—	—
1918-19 ..	21.8	Amount % of (10)	£ 20.9 16	37.4 28.7	11.9 9.2	9.6 7.4	11.4 6.7	21.3 16.3	18 13.8	130.5	6	—	—

Table VI.

GRAIN AND ROOT CROPS.—*Mangolds.*

1915-16 ..	13.5	Amount % of (10)	£ 28.3 26.	18.7 17.1	25 20.3	7.4 6.8	4.2 3.9	13.9 12.7	11.5 10.6	109	8.	268 8 1	19 17 3	8.15. per ton.
1916-17 ..	16.25	Amount % of (10)	£ 43 30.3	26.1 18.4	20.3 14.4	12.6 8.8	6.6 4.6	20.3 14.31	13.1 9.2	142	8.7	163 3 0	10 0 0	17.58. per ton.
1917-18 ..	14	Amount % of (10)	£ 35.4 34.7	21.1 18.8	11.5 10.3	12.1 10.8	6.2 5.5	14.9 13.3	10.8 9.6	112	8.	200 0 0	14 5 3	11.25. per ton.
1918-19 ..	16	Amount % of (10)	£ 80.9 32	42.9 17	21.7 8.6	57.5 22.8	13.5 5.4	19.5 7.7	10.5 6.5	252.5	15.8	286 14 2	17 8 1	17.58. per ton.

Table VII.
GRAIN AND ROOT CROPS.—*Potatoes.*

Year.	Acreage.		Labour.		Manure.		Fixed Charges.		Total Cost.	Cost per Acre.	Total Yield.	Yield per Acre.	Cost per Unit.
			Manual.	Horse.	Artificial.	F.Y.M.	Seed.	Rent and Rates.					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1914-15 ..	6	Amount % of (10)	£ 18.8 25.1	11.3 15.1	7.7 10.2	3.6 4.8	27.6 36.8	3 4	75	£ 12.5	T. c. q. 19 0 2	T. c. q. 3 3 0	80s. per ton.
1915-16 ..	6	Amount % of (10)	£	—	—	Not available.	—	—	100	16.7	14 3 0	2 7 0	142s. per ton.
1916-17 ..	12	Amount % of (10)	£ 62.2 38.9	19 11.9	15 9.4	9.3 5.8	30 18.7	1.5 9.4	160	13.3	49 17 2	4 3 0	65s. per ton.
1917-18 ..	13	Amount % of (10)	£ 70 40	20.3 12.6	19 10.9	11.1 6.3	30.8 17.6	13.3 7.9	175	13.5	41 9 0	3 3 3	94.4s. per ton.
1918-19 ..	12.75	Amount % of (10)	£ 66.7 31.5	27.1 82.8	11.5 5.4	39.6 18.7	47.9 22.6	10.4 4.9	212	16.6	43 15 2	3 8 2	97s. per ton.

Table VIII.
LIVE STOCK.—Store Cattle (including Calves) Account.

Year.	Labour.			Food.			Other Charges.		Total Cost.	No. of Stock Days.	Cost per Stock Day.	Live-Weight Particulars.						
	Manual.	Horse.	Home grown.	Purchased.	Pasture.	Vet. dines.	L. W. on Hand Opening Year.	Received during Year.				Total.	Sold during Year.	On Hand at end of Year.	Total.	L. Weight Increase on Year.	Cost per Unit of Increase.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1914-15.	Amount £	73	24.5	688.5	54.1	373.5	—	5.7	1219.3	50,963	4.9d.							
	% of (9)	5.9	2	56.4	4.4	30.6		.4										
1915-16	Amount £	81.2	15.6	889.9	9.7	354.5	5	9.4	1367.3	79,483	4.1d.							
	% of (9)	6.7	1.2	65	.7	25.9	.3	.7										
1916-17	Amount £	77.4	18.6	760.3	42.8	352.3	—	10.7	1,021.1	60,329	5.4d.							
	% of (9)	6.2	1.4	60.2	3.4	27.8		.7										
1917-18	Amount £	111.6	17	703.3	40.2	234.8	—	4.5	1111.4	60,024	4.4d.							
	% of (9)	10.1	1.5	63.3	3.6	21.1		.4										
1918-19	Amount £	155.3	34.5	417.5	51.3	401.1	2	2	1137.7	67,704	4d.							
	% of (9)	13.4	3	36.2	4.4	42.6	.2	.2										

Table IX.
LIVE STOCK.—Pigs Account.

[illegible]

Table X.—LIVE STOCK.—*Sheep Account.*

Year.	Labour.		Food.		Other Charges.		Total Stock Cost.	No. of Stock Days.	Live-Weight Particulars.										
	Manual Horse.		Home-grown.	Purchased.	Pasture.	Vet. dries.			L.W. on Hand. Opening Year.	Received during Year.	Total.	Sold during Year.	On Hand at end of Year.	Total.	L.-Weight Cost per Unit of on Year. Increase.				
	(2)	(3)														(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1914-15	Amount £	2.8	—	—	1.1	2.6	16.1	—	1.7	24.2	21,452	.27d.	—	—	—	—	—	—	—
	% of (9)	11.6	—	—	4.1	10.8	66.5	—	7	—	—	—	—	—	—	—	—	—	—
1915-16	Amount £	5.8	—	—	—	—	34.6	—	—	40.6	31,293	.31d.	—	—	—	—	—	—	—
	% of (9)	14.3	—	—	—	—	85.2	—	—	—	—	—	—	—	—	—	—	—	—
1916-17	Amount £	6.5	—	—	35.5	—	46.4	—	—	88.4	35,045	.6d.	—	—	—	—	—	—	—
	% of (9)	7.5	—	—	40.1	—	52.4	—	—	—	—	—	—	—	—	—	—	—	—
1917-18	Amount £	29.3	1	—	—	27.3	—	—	4.4	62	46,902	.36d.	—	—	—	—	—	—	—
	% of (9)	47.3	1.6	—	—	44	—	—	7.1	—	—	—	—	—	—	—	—	—	—
1918-19	Amount £	22.3	—	—	1.4	—	43.1	—	4.8	72.2	34,346	.54d.	—	—	—	—	—	—	—
	% of (9)	30.9	—	—	1.9	—	59.7	—	6.7	—	—	—	—	—	—	—	—	—	—

Table XI.—DAIRY ANALYSIS.

Year.	Labour.		Food.		Other Charges.		Total Cost.	Milk Yield Particulars.					Cost per Cwt. per Day.
	Manual.	Horse.	Home-grown.	Purchased.	Pasture.	Veterinary		Sundries.	Total Yield.	Cost per Gallon.	Daily Average of Cows.	Average yield per Cow per Year.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1915-16 ..	Amount £ % of (9) ..	73 14.6	17 3.4	288 57.8	13 2.6	95 19	4 .8	9 1.8	499	7d.	29	590	11.3d.
1916-17 ..	Amount £ % of (9) ..	95 14.2	25 3.7	402 60.2	21 3.1	123 18.4	1 .1	2 .3	669	9.5d.	33	492	13.3d.
1917-18 ..	Amount £ % of (9) ..	112 17.8	18 2.9	354 56.3	5.5 8.7	81 12.9	3 .5	6 .9	629	8d.	32	596	12.9d.

Table XII.

HORSE ACCOUNT.—*Working Horses.*

Year.	—	Labour.		Food.		Other Charges.				Total Cost.	Total Number of Horse Days.	Cost per Horse per Day.	Number of effective Horse Days.	Cost per effective Horse Day.	Maximum effective Horse Days possible.	Percentage of Actual to Maximum.
		Manual.	Horse.	Home-grown.	Purchased.	Pasture.	Veterinary.	Shoeing.	Sundries.							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
1914-15	Amount £ % of (10)	12.8 3.3	—	335 86.2	—	30.2 7.3	—	10.5 2.7	—	£ 353.5	4,380	1.5	2,654	2.5	3,636	72.9
1915-16	Amount £ % of (10)	9.8 3.4	—	235 81.6	—	30.1 10.5	1.5 .5	11.6 4	—	288	3,285	1.8	2,426	2.4	2,727	88.9
1916-17	Amount £ % of (10)	10.9 2.8	—	319.3 82.9	5.5 1.4	35 9.1	—	13.3 3.5	1 .3	335	3,650	2.1	2,668	2.8	3,030	88.1
1917-18	Amount £ % of (10)	14.7 3.8	—	313 80.7	—	40 10.2	1 .3	13.5 3.5	5.8 1.5	358	3,650	2.1	2,843	2.7	3,030	93.8
1918-19	Amount £ % of (10)	23.5 4.3	—	457 82.6	—	60 10.8	1.8 .3	11.3 2	—	553.6	3,618	3	2,586	4.3	3,042	85

Table XIII.

ALLOCATION OF "ON-COSTS" ANALYSIS.

Year 1917-18.

Crop.	—	Rent.	Rates and Taxes.	In- surances.	Super- vision.	Office Expenses.	Bank Interest.	Fences and Roads.	Allow- ances.	Imple- ments.	Sup- plies.	—	Grand Totgl.	Per Cent. of Grand Total.	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Oats	Acres. 74.5	£ 63.8	£ 15.7	£ 2.9	£ 17.1	£ 3.93	£ —	£ 8.6	£ 2.8	£ 13.4	£ 4.1	—	—	137.33	13.2
Barley	..	11.6	2.0	.5	3.1	.72	—	1.6	.5	3.35	.74	—	—	25.01	2.4
Wheat	..	12.1	3	.55	3.2	.75	—	1.6	.5	3.47	.76	—	—	25.93	2.5
Potatoes	..	11.1	2.8	.5	3	.7	—	1.5	.5	3.21	.71	—	—	24.02	2.3
Mangolds	..	12.1	3	.55	3.2	.75	—	1.6	.5	3.47	.76	—	—	25.93	2.5
Turnips	..	3.3	.8	.1	.9	.2	—	.4	.1	.9	.21	—	—	6.91	.7
Oats and Vetches	..	26.5	6.5	1.2	7.1	1.63	—	3.5	1.1	7.6	1.69	—	—	56.82	5.4
Catch Crops	..	26.7	6.7	1.2	7.2	1.67	—	3.6	1.2	7.8	1.72	—	—	57.79	5.5
Pasture	..	317.8	78.6	14.5	85.2	19.65	—	42.6	13.8	91.8	20.31	—	—	684.26	65.5
Total Crop ..	Amount, % of (13)	485 46.5	120 11.5	22 2.1	130 12.4	30 2.9	—	65 6.2	21 2	140 13.4	31 3	—	—	£1,044 Totals.	—

Table XIV.

ANALYSIS OF PROFITS AND LOSSES.

Year.	Per Cent. of Profit or Loss to Capital.	—	Store Cattle.	Dairy.	Sheep.	Pigs.	Poultry.
1914-15	Profit .. 8.9	Capital Value Profit or Loss % of Valuation	£ 2,420 £ 250 10.3	462 34* 7.4	114 126 110.5	80 82.5 103.1	15.6 9.5 60.9
1915-16	Loss .. 4.9	Capital Value Profit or Loss % of Valuation	£ 2,233 £ 383* 17.1	601 20.5* 3.5	218 139.5 63.8	80 17 21.2	19 21 110.5
1916-17	Profit .. 10.2	Capital Value Profit or Loss % of Valuation	£ 1,992 £ 1,215 6.1	699 24.5* 3.5	265 115.5 43.6	54 118 218.7	20 32 160
1917-18	Profit .. 17.3	Capital Value Profit or Loss % of Valuation	£ 2,498 £ 379.5 15.3	797 17.5 22.3	273 152.6 55.9	142 213.2 150.1	27 108.8 403
1918-19	Profit .. 25.8	Capital Value Profit or Loss % of Valuation	2,859 516 19.1	952 315 33.1	240 155 64.6	231 164 68.6	30 154 513

* Loss.

Table XV.

ANALYSIS OF MANUAL AND HORSE LABOUR.

Year.	Acreage.	Manual Labour.		Horse Labour.	
		Total Amount.	Amount per Acre.	Total Amount.	Amount per Acre.
1915-16	368	£ s. d. 367 19 7	£ s. d. 1 0 0	£ s. d. 255 2 10	£ s. d. 0 8 11
1916-17	368	399 4 1	1 1 1	300 14 8	0 10 7
1917-18	368	877 15 7	1 10 10	289 0 2	0 10 2
1918-19	368	1,166 2 3	2 1 0	419 4 2	0 14 9

CAPPOQUIN FARM.

Table XVI.

STATEMENT FOR WEEK ENDING

, 1919.

<i>Sales of Live Stock.</i>			<i>Losses of Stock.</i>		
	<i>No.</i>	<i>c. qr.*</i>		<i>No.</i>	<i>c. qr.*</i>
Store Cattle			Store Cattle		
Dairy Cattle			Dairy Cattle		
Sheep			Sheep		
Pigs			Pigs		
<i>Purchases of Stock.</i>			<i>Threshing Output.</i>		
	<i>No.</i>	<i>c. qr.*</i>		<i>c. qr. lb.</i>	
Store Cattle			Oats, Grain		
Dairy Cattle			" Straw		
Sheep			Barley, Grain		
Pigs			" Straw		
<i>Transfers of Stock.</i>			<i>Birth of Calves</i>		
	<i>Weight. Value*</i>			<i>Number.</i>	
Stores to Dairy ..			Store Heifers		
Dairy to Stores ..			Dairy Cows		
Calves to Stores ..					
Young Horses to					
Working Horses.					
			<i>Yield of Milk.</i>		
				<i>lb.</i>	

OUTPUT OF MANURES.

(†)	Nitrate of Soda.	Sulphate of Am- monia.	Basic Slag.	Super- phos- phate.	Kamit.	Salt.	Liquid Manure.	Farm- yard.
	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>	<i>Gal.</i>	<i>Lds.</i>
Oats								
Barley								
O. and V. ..								
C. Crops.. ..								
Potatoes ..								
Mangolds ..								
Turnips								

* Year in every case to be stated.

† Artificial Manure in cwt., Farmyard Manure in loads, Liquid Manure in gallons.

.....Steward.

EAR COCKLES IN WHEAT.

W. SOMERVILLE, M.A., D.Sc.,

Sibthorpian Professor of Rural Economy in the University of Oxford.

IN the issue of this *Journal* for October, 1918, there appeared a short account of an experiment which demonstrated the ease with which a wheat field may become contaminated by using seed containing ear cockles. These are black or dark brown bodies, usually somewhat less in size than a grain of wheat. They contain great numbers of an eelworm (*Tylenchus scandens*), which invades the young plant from the soil and greatly interferes with its growth and yield. In 1917-18 the only preventive "steep" that was employed was a 1 per cent. solution of copper sulphate, and this had only a small effect in destroying the eelworms when the cockles were immersed in it for 24 hours.

The experiment, with certain additions, was repeated in duplicate in 1918-19, the variety of wheat employed being Red Standard, of which 20 grains were sown on 8th November, 1918, in each pot. The average germination of the untreated seed was 81 per cent. The pots containing the wheat seed were kept in a cold greenhouse from the date of sowing until 16th December, when they were placed in the open air, and kept thus exposed until the produce was cut and weighed on 5th August, 1919. An attempt was also made to infect rye (pots 3 and 3A), but without success, so that this crop, as well, it is believed, as oats and barley, seems to be free from the risk of attack.

Result of Infection.—A tabular statement of the results is given on p. 909.

Three duplicate pots (6 in all) each received 20 grains of wheat. To pots 1 and 1A no cockles were added, while to pots 2 and 2A 20 cockles each were added when the grain was sown on 8th November, and in the case of pots 10 and 10A 20 cockles were also added, but not till 4th April, 1919. When the grain was ripe in August there were no cockles on the ears of plants growing in pots 1 and 1A, thus showing that soil and grain were uncontaminated with *Tylenchus*. Where infection was made in autumn, 1918, (pots 2 and 2A) considerably more than half of the whole number of ears were more or less affected with cockles, the actual number of cockles produced in the two pots being 285. The number of wheat grains was reduced from 267, weighing 7.3 grams (1 and 1A), to 98, weighing 1.9 grams

(2 and 2A). There was, however, no reduction, but rather an increase, in the weight of straw, which was due to the fact that the attack of eelworms, by preventing the normal formation of ears, stimulated the plants to produce a great number of weak side shoots (tillers). The straw of all infected plants had a characteristic crinkled or corrugated appearance. Where the addition of the cockles was delayed for 5 months (pots 10 and 10A), *i.e.*, till 4th April, infection was practically as complete as when the cockles were sown along with the seed, and the yield was equally reduced. The results of this part of the experiment are shown in Fig. 1.

Copper sulphate was employed as a "steep" in two strengths, *i.e.*, 1 per cent. and 5 per cent. In both cases the grain and cockles were submerged in the fluid for 24 hours. The weaker solution had in one case a marked effect on the germination capacity of the grain, and it must also have destroyed a large proportion of the eelworms, as the number of cockled ears in the two pots (4 and 4A) was only 3, as contrasted with 19 where no steep was used, while the total number of cockles was reduced from 285 to 11. These figures show a great advance on the 1918 results, and are probably due to the greater care which was taken to keep the cockles completely submerged in the solution during the 24 hours of steeping. While, therefore, a 1 per cent. solution of copper sulphate kept in contact with the cockles for 24 hours has in this case destroyed most of the eelworms, it is probable that in farming practice such complete immersion would be difficult to secure. In any case the reduction in the vitality of the grain is somewhat serious. Where the copper sulphate solution was 5 per cent. in strength, the eelworms were entirely destroyed and no infection occurred, but as the germination of the grain was reduced on an average by 45 per cent. it is obviously an impracticable system. (See Fig. 2.)

Commercial formalin was used of a strength of $\frac{1}{2}$ per cent., and 1 per cent., in which the wheat and cockles were immersed for 24 hours. In the case of the stronger solution the vitality of the wheat was entirely destroyed, and not a single plant appeared. With the weaker solution the wheat germinated on an average 10 per cent., as compared with 80 per cent. where entirely untreated, so that, whatever the effect on the cockles, formalin employed as indicated is outside practical consideration. In point of fact, although these solutions had such an injurious effect on the embryo of the wheat grain, they failed to kill the eelworms. The four wheat plants which appeared

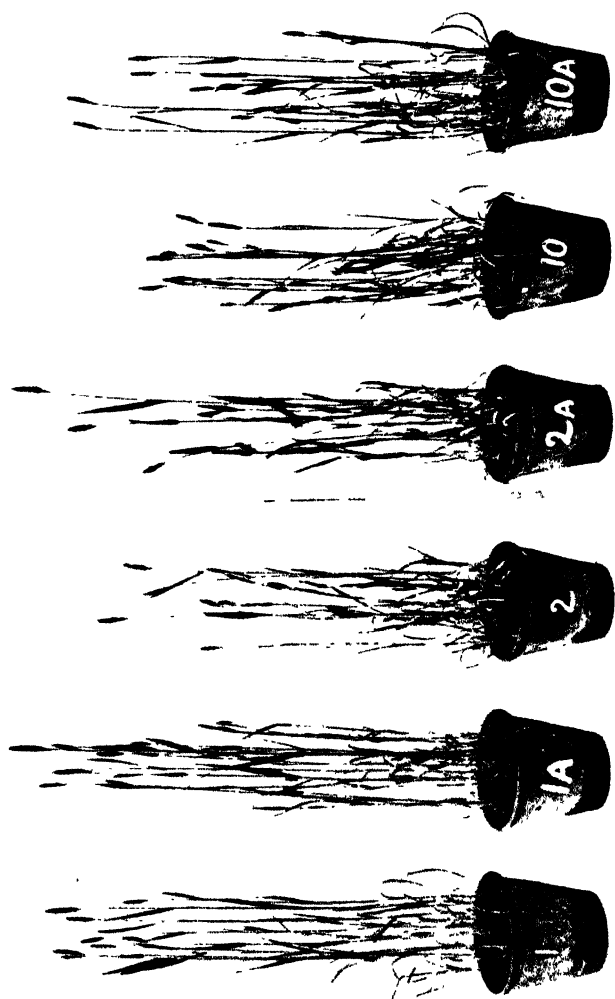


FIG. 1.—Plants 1 and 1A were not infected with Cockles. The other 4 pots were supplied with 20 Cockles each, which were sowed with the Gun in pots 2 and 2A, but were not sowed until 4th April in the case of Pots 10 and 10A. No steep was used for any of these pots.

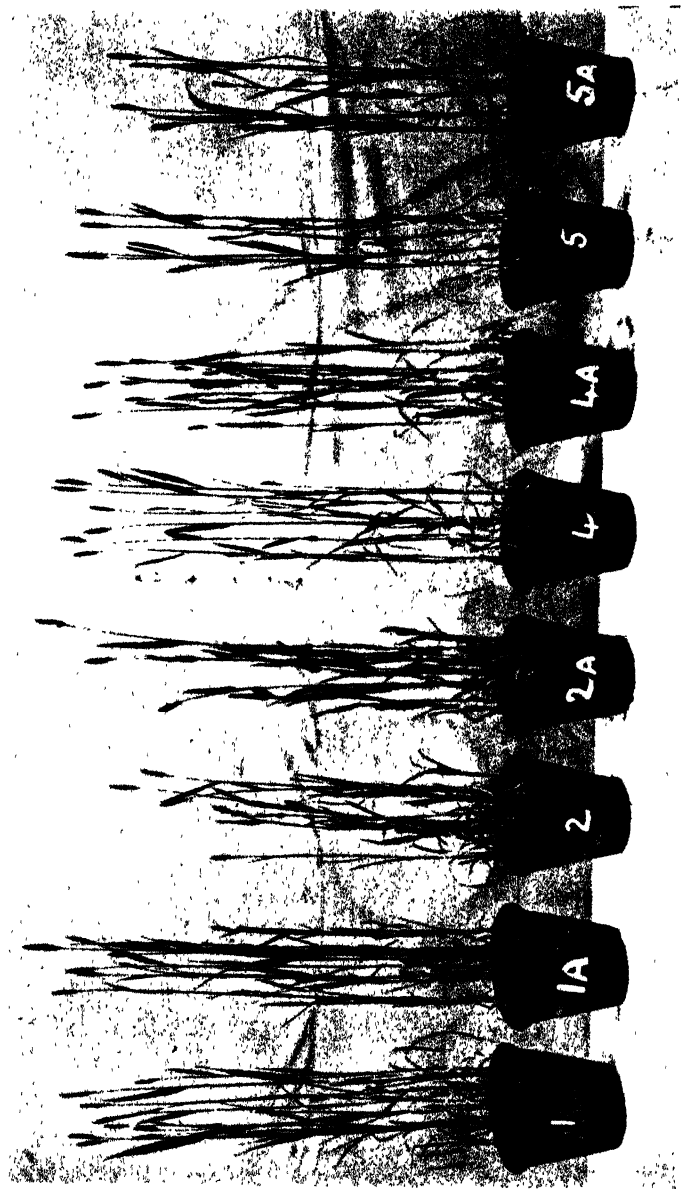


FIG. 2.—Pots 1 and 1A were not infected with Cockles, but in the case of the other 6 pots Cockles equal in number to the grains of Wheat were sowed on 8th November. No treatment was given in the case of Pots 2 and 2A, but in the case of Pots 4 and 4A the Grain and Cockles were steeped for 24 hours before sowing in a 1 per cent. solution of copper sulphate, while for Pots 5 and 5A the Grains and Cockles were steeped for 24 hours in a 5 per cent. solution of the same substance. The thin stocking of Pots 5 and 5A is due to many of the Grains having been killed by the strength of the steep.

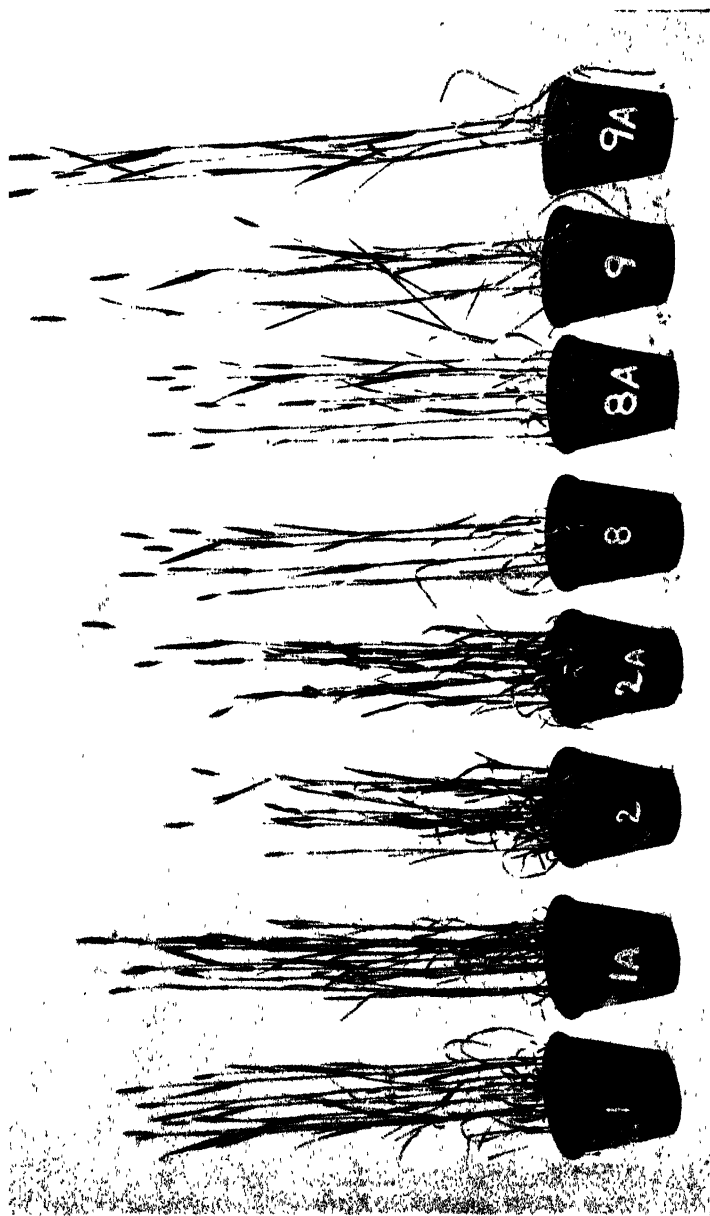


FIG. 3.—Pots 1 and 1A were not infected with Cockles, but an equal number of Cockles and Grain were sowed in the other pots. No steep was used for the Grain and Cockles of Pots 2 and 2A, but in the case of Pots 8 and 8A both were steeped for 24 hours in a $\frac{1}{2}$ per cent. solution of sulphuric acid, while for Pots 9 and 9A the strength was 1 per cent. In both cases many of the grains were killed, which accounts for the thin stocking.

in pots 6 and 6A ($\frac{1}{2}$ per cent. formalin) were removed on 16th December, and these pots, as well as pots 7 and 7A (1 per cent. formalin), where no plants appeared, were reseeded with untreated seed on that date, with the result that at harvest the wheat plants in three of the four pots showed more cockles than any of the whole series.

Sulphuric acid solutions of a strength of $\frac{1}{2}$ per cent. (pots 8 and 8A) and 1 per cent. (pots 9 and 9A) were tried, steeping in this case also lasting 24 hours. Both of these solutions completely destroyed the eelworms, but as they also reduced the germination of the grain by a half or more, they may be regarded as out of consideration for practical purposes. (See Fig. 3.)

Conclusion.—The practical conclusion that emerges from this demonstration is that if wheat is contaminated with cockles it should not be used for seed, for, although eelworms may be killed by steepings of copper sulphate and sulphuric acid, the solutions must be of such strength, or steeping must be continued so long, that the germinative capacity of the grain is greatly impaired.

Pot No.	Treatment.	Percentage Germination.	No. of Plants on				No. of Ears.	Number of Ears Cockled.	Number of Grains.	Number of Cockles.	Weight of	
			16th Dec., 1918.	4th April, 1919.	5th Aug., 1919.	5th Aug., 1919.					Grain.	Straw.
1	None	75	15	13	13	18	14	0	130	0	grams.	grams.
1A	"	85	17	15	15	23	16	0	137	0	3.6	14.9
2	20 " wheat grains + 20 cockles	80	16	15	15	39	14	8	69	126	1.0	17.0
2A	Ditto, ditto, steeped in 1 per cent. copper sulphate ..	75	15	12	12	36	13	11	29	159	0.9	23.1
4	Ditto, ditto, steeped in 1 per cent. copper sulphate ..	60	12	11	11	18	12	1	126	4	3.5	14.5
4A	Ditto, ditto, steeped in 5 per cent. copper sulphate ..	75	15	13	13	25	14	2	96	7	2.7	16.3
5	Ditto, ditto, steeped in 5 per cent. copper sulphate ..	30	6	6	6	18	6	0	95	0	2.3	8.7
5A	Ditto, ditto, steeped in 1 per cent. formalin	40	8	8	8	16	8	0	102	0	3.0	15.0
6	Ditto, ditto, steeped in 1 per cent. formalin	15	*3	11	11	50	9	7	13	168	0.2	15.3
6A	Ditto, ditto, steeped in 1 per cent. formalin	5	*1	15	15	48	15	14	15	171	0.1	17.9
7	Ditto, ditto, steeped in 1 per cent. formalin	0	*0	16	16	35	14	7	79	30	1.7	16.3
7A	Ditto, ditto, steeped in 1 per cent. formalin	0	*0	16	17	16	16	13	21	181	0.6	14.4
8	Ditto, ditto, steeped in 1 per cent. sulphuric acid ..	25	5	5	5	17	5	0	86	0	2.6	8.4
8A	Ditto, ditto, steeped in 1 per cent. sulphuric acid ..	40	8	8	8	13	8	0	87	0	2.3	10.8
9	Ditto, ditto, steeped in 1 per cent. sulphuric acid ..	30	6	6	6	16	7	0	88	0	2.8	8.7
9A	Ditto, ditto, steeped in 1 per cent. sulphuric acid ..	15	3	3	3	11	3	0	99	0	3.5	12.5
10	As No. 2, but cockles not added till 4th April ..	80	16	14	13	34	13	10	24	56	0.7	16.8
10A	"	90	18	15	15	37	17	10	43	149	1.2	20.8

* Resowed 16th December, 1918.

PROFIT AND LOSS SHARING ON THE FARM.*

JAMES WYLLIE, B.Sc.

I. Object of Profit-Sharing.—To improve the social, economic, and general relationships between employer and employees ; to bring them to recognise that their interests are common and not antagonistic ; and thereby to increase the total annual income or earnings of both employer and employees

II. Conditions essential to Success.—There must be no feeling of compulsion on either side. The employer must admit the employees' claim to share in the profits as presently earned ; the employees must admit that the increase in profits which is expected to accrue under a successful scheme of profit-sharing will be due to better organisation and management on the part of the employer as well as to higher efficiency in the labour department, and, therefore, that the employer is equitably entitled to share in such increase.

(2) There must be a proper system of accounting.

(3) Both employer and employees must follow the spirit as well as the letter of the scheme, and there must be no attempt on either side to snatch an unfair advantage either in drafting the terms of the agreement or in carrying them out.

(4) The scheme should be as simple as possible, especially to begin with, on the principle that one is not so likely to give unqualified support to something which one does not fully understand.

III. Definition of Profit.—The term " Profit " shall be interpreted as follows :—In making up the Profit and Loss Account for the year, expenses chargeable against the farm shall include, *inter alia*, (a) the total wages, including the value of all perquisites, payments for overtime, harvest-money etc., paid to each employee of whatever kind ; (b) interest on the capital invested by the employer as shown by the farm balance-sheet ; (c) an allowance to the employer for ordinary work done on the farm by himself or by members of his family as well as for the work of organisation and management—this allowance to be hereafter called " employer's wages."

* Mr. James Ismay, Iwerne Minster House, Blandford, Dorset, some months ago offered a prize of £100 for the best scheme on the subject of " Profit and Loss Sharing on the Farm," sent through ten agricultural newspapers, and, in addition, £10 for the best scheme submitted through each newspaper. This article, which is reprinted from the *North British Agriculturist* for 25th September, 1919, was awarded both prizes, as judged the best submitted through all the newspapers. The names of the final adjudicators were.—C. J. B. Macdonald, Esq., West End Farm, Cheddington, Tring ; H. Padwick, Esq., National Farmers' Union, 39, Victoria Street, S.W. 1 ; G. Dallas, Esq., The Workers' Union, 49, Chandos Street, Strand, W.C. 2.

IV. The farm shall be credited with (a) the estimated yearly value of the dwelling-house occupied by the employer and his household, and (b) the value of all farm produce consumed by the employer and his household. Income Tax payable by the employer, as well as all other payments of a personal nature, shall be excluded, but a fair allowance shall be made for depreciation on machinery and other equipment.

V. **Employees' Wages.**—Employees' wages shall, on no account, be lowered simply because they are to share in the profit, and the wages of employees and of employer shall rise or fall together. All perquisites shall be valued according to the scale adopted by the Wages Board for the district in question.

VI. **Interest on Capital.**—The rate of interest allowed on the employer's capital shall be based upon the current rate paid by first-class industrial stocks or shares or alternatively, as may be agreed, upon the current bank rate plus 1 to 2 per cent. It shall be the duty of the auditor(s) to see that the amount of capital on which interest is calculated is fair and reasonable, and in particular that stocks in hand are not over-valued, and that only such monies are included in the balance sheet as are necessary for the proper working of the farm.

VII. **Employers' Wages.**—The employers' wages shall be based upon the salaries actually paid to managers of home and co-operative farms, etc., in the district in question, or alternatively, as may be agreed, upon a sum representing from 8 to 12 per cent. of the employers' capital as above determined.

VIII. The yearly value of the farm dwelling-house shall be taken as it appears in the valuation roll, or, failing that, it shall be assessed on the same basis as cottages included in employees' perquisites. Similarly, all farm produce consumed by the farmer and his household shall be assessed in the same way as where that produce is given as employees' perquisites. Local rates shall be allocated amongst employees, employer, and the farm according to the same principles as are implied in the above.

IX. **Employees' eligible to Share.**—Only employees regularly engaged on the farm shall be eligible for participation in the profit, *i.e.*, all employees engaged by the week, month, half-year or year as well as regular day-workers, such as milkers. No employee shall be eligible who has not been in the service of the employer for a period of at least six consecutive months, but not necessarily full time. In the course of about 5 years this period may be extended to twelve months.

X. Principle of Sharing Profit.—The profit as above determined shall be apportioned as follows:—

(1) Ten per cent. of the profit shall be placed in a reserve fund, subject to par. 11.

(2) The remainder of the profit shall be divided amongst (a) the employer, (b) eligible employees, and (c) other employees in proportion to the total wages paid to each class.

(3) The proportion falling to ineligible employees shall be added to the reserve fund.

(4) Before apportioning the eligible employees' share, 2 per cent. of the wage shall be added to each employee's wage for each full year of service after the first. The final division shall be made amongst the eligible employees in proportion to the total wages as thus adjusted.

(5) The profit thus allocated shall be paid in cash.

XI. Reserve Fund.—A reserve fund shall be set up as stated in par. 10, but this fund shall not be allowed to exceed an amount to be agreed upon, such as one year's wages of employer and employees. If and when the reserve fund reaches the maximum the whole profit shall be apportioned and the amount falling to the ineligible workers shall be divided equally between the employer and the eligible employees.

XII. In the Event of Loss.—In the event of the year's working resulting in a loss, either (a) the loss shall be carried forward and no profit shall be divided until this loss has been made good, or, (b) the reserve fund shall be drawn upon to the extent of the loss, but no more, or, (c) the reserve fund shall be drawn upon to the extent of the loss, and also sufficiently to pay not less than 5 nor more than 10 per cent. on the wages of both employer and employees—all according to the state of the reserve fund and by agreement.

XIII. Books to be Audited.—The accounts shall be audited each year by an auditor mutually approved by employer and employees, and his decision shall be final.

XIV. Before any employee shall be eligible to share in the profit he or she must agree in writing to the terms of the agreement as sketched above.

XV. Notice to Terminate.—One year's notice shall be given by either party in order to terminate the agreement, and in the event of determination the reserve fund shall become the property of the employer as a measure of compensation for the risk he runs in having the agreement terminated, while the scheme shows a loss without any reserve fund.

Note (1) The term "profit" has been defined for the particular purpose in view.

(2) The above scheme is intended for tenant-farmers and their employees, but it could readily be adapted to suit the case of proprietor-farmers and their employees.

(3) It will be understood that in practice the agreement outlined above will require amplification so that there may be no misunderstanding on any of the points raised.

(4) No attempt has been made to discuss the relative advantages of co-partnership and profit-sharing.

IN any County Scheme of instruction with the object of encouraging such an industry as cheese-making, it is essential that the methods adopted should be framed to meet the specific needs of the county concerned. This has recently been notably exemplified in the case of a certain county, in which, until last year, it had been customary to hold cheese-making classes at farms where it was part of the normal business to make cheese.

Owing to the reluctance of farmers to admit strangers on the premises it gradually became more and more difficult to provide centres of instruction for would-be pupils, and at the end of the 1918 season the Education Authority decided to discontinue the instruction. An officer of the Board, on hearing of this decision, attended a subsequent meeting of the Committee and succeeded in persuading them to rescind their previous decision and to continue the classes on a different plan. It was then arranged to hold short courses, usually of a fortnight's duration, at a number of centres. Instead of dealing with large cheeses and large quantities of milk, the instruction was designed to show how, with quite simple and inexpensive apparatus, good cheese could be made from comparatively small quantities of milk. In short, the courses of instruction were such as would meet the needs of small holders, and demonstrate the possibility of converting small surpluses of milk into cheese with very little outlay.

The classes under this new plan were from the beginning a great success, and more applications for new centres were received than could be dealt with in the season. The net cost to the county, moreover, was very small. Numerous applications have already been received for the formation of classes next year in the county referred to.

Instruction of this kind, taken as it is to the very doors of those requiring it, is of real economic value, and is much appreciated by those concerned. It also saves in the aggregate a large amount of milk from being put to a less useful purpose than is the case when it is made into cheese, and at the same time gives the small holder a greater return for his produce than he would otherwise obtain.

Time to apply Farmyard Manure.—The very fine autumn weather enabled farmers to push well forward with their cultivations, and work on many farms is at present advanced more than usual. **Notes on Manures for January:** Farmers have, therefore, the option of putting on farmyard manure now, instead of waiting, as they are sometimes compelled to do, until spring. There has been a good deal of discussion as to whether spring or winter applications of farmyard manure are best, and equally good farmers may have opposite views. The general rule seems to be as follows:—

Winter application of farmyard manure is best in districts of low rainfall, *i.e.*, the eastern, midland and south-eastern counties, while spring application is best in districts of high winter rainfall—*i.e.*, the north and north-west of England, south-west of Scotland, etc.

The danger of spring application of farmyard manure in the southern part of England was illustrated this season on one of the fields at Rothamsted. Here, owing to pressure of work in the autumn of 1918, the usual cartage of dung had not been completed when the wet weather of January and February put a stop to work on the land: a spring dressing of farmyard manure had therefore to be applied. March, April and May were all dry months, and the drought extended well into June. The manure had little opportunity for decomposition, and clearly did not exert the effect in improving the root crop that might reasonably have been expected.

The subject has been put to the test of direct experiment by Professor Berry of the West of Scotland Agricultural College, whose results were published in 1914.* Adopting the money values then current he found in his wet district that spring dressings gave an advantage of £4 11s. per acre in the case of potatoes, and 19s. per acre in the case of swedes: the

* Eleventh and Twelfth Annual Report of the West of Scotland Agricultural College, Glasgow, 1914.

spring dressings gave 40 per cent. to 60 per cent. increase in weight over the unmanured plot, while the autumn dressings gave only 25 per cent. increase.

His actual figures were :—

	<i>Potatoes.</i>			<i>Turnips.</i>		
	Increase over Unmanured Plot.			Increase over Unmanured Plot.		
	Weight per acre.	Money value per acre.	Per cent.	Weight per acre.	Money value per acre.	Per cent.
	T. c.	£ s. d.		T. c.	£ s. d.	
Spring application	4 2	9 3 2	57	6 2	2 8 6	41
Autumn application	2 1	4 12 0	26	3 14	1 9 6	25

In an earlier experiment Dr. Somerville also found that spring dressings gave the best results for swedes and turnips in Northumberland, the yields per acre being :—

	Dung alone	Dung and Artificials.	
	Tons cwt.	Tons cwt.	Tons cwt.
9 tons applied in winter	17 13½	22 17½	18 16½
9 „ stored, then applied in spring ..	20 17	23 16	22 13½
Advantage in favour of spring application	3 3½	0 18½	3 17½

A similar result was obtained by Professor Gilchrist in 1906-7. His results for swedes were :—

	No dung.	Dung (10 tons) applied in December.	Dung (10 tons) stored, applied when swedes sown.	Dung (10 tons) fresh, not stored, applied when swedes sown.
	Tons cwt.	Tons cwt.	Tons cwt.	Tons cwt.
No other manure	12 16	15 5	18 19	17 17
Artificials added	17 13	18 18	20 17	20 3

This result is not invariably obtained, however, in Durham and Northumberland: in another season Dr. Somerville

found that mangolds gave better results after autumn dressings than after spring dressings, the results being:—

					<i>Tons cwt.</i>
Dung (20 tons)* in autumn	28	17			
„ (16½ „)* in spring	26	17½			

Only 16½ tons were applied in spring to allow for loss on storage: naturally this figure must affect the results considerably. Broadly speaking, however, it may be said that spring applications of farmyard manure are best in the north.

Farther south the case stands quite differently, and whenever the matter has been tested the winter applications have come out best. Two good experiments have been made; one at Harper Adams Agricultural College, and the other at the Holmes Chapel Agricultural College (now closed). At Harper Adams potatoes receiving spring dressings of farmyard manure looked better at first than those which got a winter dressing, but by July a great change was visible, and by the middle of August they looked distinctly less promising than those to which farmyard manure had been applied in winter. The final weighings of the tubers were:—

				<i>Spring Application. Tons cwt.</i>		<i>Winter Application. Tons cwt.</i>
Culdees Castle	10	12½	..	11	3	
Crofter	10	3	..	10	13½	
Great Scot	12	3½	..	13	4½	

showing distinct gains in favour of the winter dressings.

At Holmes Chapel the following results were obtained in a four years' test on loam and strong clay:—

					<i>Tons per Acre.</i>
			<i>Potatoes.</i>	<i>Swedes.</i>	<i>Mangolds.</i>
Dung applied in December	5·7	14·5	22·1		
„ „ April	5·5	12·8½	17·7		
Advantage of winter dressing	—	1·7	4·4		

Only when the dung has been applied early has it any chance of decomposing sufficiently to exert any great effect on the water-holding capacity of the soil. Long dung does not help to keep the soil moist in dry weather; on the contrary it favours drying out. If, however, the long dung is ploughed in during the winter it decomposes sufficiently to enable the soil to retain more water in the spring.

Collection of Bracken.—Farmers who use bracken should collect it as soon as possible, as it rapidly loses value during the winter.

* 10 cwt. artificials per acre added in each case.

Exposure to rain after it is dead and withered causes most of its valuable constituents to wash away: thus, bracken collected at Rothamsted contained when fully grown 29 per cent. of potash (K_2O) in its ash, but after exposure throughout the winter it contained only 2 per cent. Expressed as lb. of potash (K_2O) obtainable from an acre of bracken, the figures were 60 lb. per acre in bracken collected in October, but only about 5 lb. per acre in bracken collected at the end of winter.

Effect of a Wet Winter.—Supposing there should be heavy rainfall during the winter, farmers will be under the necessity of providing additional nitrogenous manure by way of spring dressings to make up for the loss of nitrate in the drainage water. The extent of the loss depends on the richness of the soil and the amount of rainfall, but it may be considerable. At Rothamsted it is in no case less than 1 lb. of nitrogen (equivalent to 6 lb. of nitrate of soda) per inch of rain, and this low figure is attained only on the poorest and most exhausted land on the farm. More usually the figure is much higher. Careful notes were kept during the wet winter of 1915-16, and it was found that the total losses throughout the whole winter varied from 5 to 125 lb. per acre (reckoned as nitrogen); in the case of a field worked as part of the ordinary farm the loss was 30 lb. of nitrogen per acre, equivalent to 190 lb. per acre of nitrate of soda, this being as much as is contained in 18 bushels of wheat together with the corresponding quantity of straw. A piece of fallow land lost very heavily. The actual figures were:—

<i>Nitrogen as Nitrate.</i>			
<i>Lb. per acre, top 18 in.</i>			
	<i>Autumn,</i>	<i>February,</i>	
	1915.	1916.	<i>Loss.</i>
Broadbalk, dunged, fallow ..	175	50	125
„ „ „ cropped (wheat)	90	47	43
Great Harpenden Field, cropped (wheat)	70	40	30
Broadbalk, unmanured, fallow ..	68	40	28
„ „ „ cropped (wheat)	51	46	5
Hoos, unmanured, fallow ..	34	9	25
„ „ „ cropped (wheat)	32	12	20

In addition to the losses of nitrate the soil also suffered through deflocculation of the clay. Thus, at the end of the winter the land was depleted of its nitrates, and the clay had passed into a sticky, unworkable state. Much of the damage could have been avoided had a catch crop or a green crop

been grown in the previous autumn and subsequently ploughed in for manure. The best remedies for spring use are soot, sulphate of ammonia and lime, and, where the soil is not too heavy and sticky, nitrate of soda.

If the winter turns out to be wet, farmers on heavy land will be well advised to secure soot early.

Ammonium Nitrate as Fertiliser.—Information has been received from the Disposal Board of the Ministry of Munitions that they are unable to accept any further orders for ammonium nitrate as fertiliser; quotations are still given however, by some of the merchants. Fortunately there seems to be a considerable quantity of nitrate of soda in view, so that farmers wishing to use nitrates should be under no disadvantage in arranging a manurial programme for next spring.

Purchase of Lime on Farms.—Recent quotations for different kinds of lime are as follow:—

						<i>Price per ton.</i>
Ordinary lime	..	..	..	..	..	28s.
Ground lime	..	..	..	..	..	42s.
„ limestone	..	..	..	..	..	34s.

and the question arises, which of these is the best value?

Lime is usually about 90 per cent. pure: limestone also is equally pure, but it contains carbonic acid (which is of no value to the farmer) in addition to lime, so that its content of the valuable lime on the 90 per cent. basis of purity is reduced to 51 per cent. The relative cost per ton of lime therefore works out as follows:—

						<i>Price per ton.</i>
Ordinary lime	..	..	..	..	..	28s.
Ground lime	..	..	..	..	..	42s.
„ limestone	..	..	..	..	..	60·5s.

The difference in value between ordinary lime and ground lime lies in the fineness of division. The ground lime, being in fine powder, can be well distributed in the soil, and, therefore, need not be used in as large dressings as the ordinary lime. Whether there is as much difference as is shown in these quotations depends on the actual samples. Limestone has one advantage over ground lime: it can be kept more easily in the bag, as it does not swell and become hot on wetting in the way lime does. In many places, however, lime is available at a cheaper rate than any of the above: Professor Gilchrist reports an instance in which waste lime is being offered at 8s. per ton (on rail), which, assuming only 36 per cent. of lime, is equivalent to a cost of 20s. for lime on the 90 per cent. basis. It is, however, variable in composition, and contains from 60 to 70 per cent. carbonate of lime, which is equivalent to 34 to

39 per cent. of lime. The carbonate of lime is in a finely precipitated powder. At Cockle Park, 4 tons per acre of this has effectively checked finger-and-toe disease in turnips, and in other ways has given valuable results. It is carefully spread direct from the carts on to the soil, before ploughing the ley for oats, at the rate of 4 tons per acre, and this application once in a rotation of four or six years has been as effective as any form of lime used.

Mr. Scott-Robertson reports two waste limes from Essex: the figures of analysis are as follows:—

					Sample 1. per cent.	Sample 2. per cent.
Moisture	..	..	..	..	37.92	—
Calcium oxide (lime)	..	..	..	..	31.13	40.53
Sand, etc.	..	..	..	..	—	4.70

Sample 2 comes from a soap works in Essex, and costs 1s. 6d. per ton free on rail. Sample 1, which was very wet and pasty, is derived from a factory in the London area, and cost at the time of writing 6s. 6d. per ton free on rail at the works.

Use of Lime in Nurseries.—A correspondent has asked whether the need of lime is as urgent in nurseries as on farms? In many cases it is not. Some crops, like potatoes and rhubarb, grow better without lime than with it: both of these prefer a rather acid soil, and in the case of potatoes, one of the pests—the well-known potato scab—can flourish in a limed, but not in an unlimed, soil. Both on account of its manner of growth and to avoid this pest, therefore, the potato crop is better without a direct application of lime than with it. Again, in the few experiments that have been made, tomatoes have done better without than with additional lime, but in these cases there was already a certain proportion of lime in the soil. Where raw subsoil is being turned up it seems highly probable that a dressing of lime will be valuable: where, however, only the surface soil is being dealt with, the need for lime must depend on the crop. The cabbage tribe, swedes, etc., are usually the first to suffer from shortage of lime, and they show the effect by the well-known finger-and-toe or club-root, which is not to be confused with the club-root of tomatoes, or the galls produced by certain insects on swedes.

Price of Potassic Fertilisers.—A farmer sends the following list of prices, which he has quite naturally had some difficulty in comparing. He was offered:—

		£	s.	d.	
French Kainit (Sylvanite) 14 per cent.	.. at	7	15	0	per ton.
Potash Salts (K ₂ O) 30 per cent.	.. „	12	10	0	„
Muriate of Potash (KCl) 80 per cent.	.. „	20	12	6	„
Sulphate „ (K ₂ SO ₄) 90 per cent.	.. „	23	2	6	„

and he asks how to determine which is the best value? The method is as follows:—

Manure.	Price per Ton.			Composition.	Equivalent to	Price per Unit*
	£	s.	d.	Potash.	Potash.	s. d.
French Kainit (Sylvanite)	7	15	0	14 % (K ₂ O)	14 % (K ₂ O)	11 1
Potash Salts ..	12	10	0	30 % (K ₂ O)	30 %	8 4
Muriate of Potash ..	20	12	6	80 % (KCl)	50·5 % (K ₂ O)	8 2
Sulphate „ ..	23	2	6	90 % (K ₂ SO ₄)	48·6 % (K ₂ O)	9 6

1 part of muriate (KCl) = 0·632 parts of potash (K₂O).
 1 „ sulphate (K₂SO₄) = 0·54 „ „ (K₂O).

THE Report of the women delegates appointed to inquire as to openings in Canada for women of the United Kingdom, recently published,* devotes considerable attention to the position of women settlers with regard to agricultural employment.

The delegates point out that, owing to climatic conditions, hired labour upon most Canadian farms is of a seasonal nature. Agricultural hands are in great request from May to October, but during the severe winter months have to find alternative employment, either in towns or at lumber work. In view of this fact, there is little prospect of whole-time farm employment for women.

On the other hand, the war emergency has brought women into prominence as seasonal workers in fruit districts. A corps of "Farmerettes" was enlisted for special service in this connection in Ontario and in British Columbia during the 1918 and 1919 seasons. Their organisation, both as regards enrolment and supervision, was carried out on much the same lines as those adopted in Great Britain, and the work performed was so satisfactory that fruit farmers are anxious to ensure a continuance of this class of labour. Inasmuch, however, as, even in fruit districts, little or no outside work can be performed in winter, the only employment open to women during that period of the year is domestic work. The delegates express the opinion that good openings exist for a certain number of young women who are willing to adapt themselves to the above conditions of seasonal employment, and that the wages would compare

* Cmd. 403, 1919, 4d. net. Obtainable from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2.

favourably with those earned in Great Britain. Opportunities for the farm-house servant employed partly in and partly outside the house seem also to be available in several Provinces. As, however, this type of labour is not customary, it is felt that only a limited number of carefully selected women prepared to adapt themselves to local requirements and conditions should be advised to consider such posts, and that they should be informed that the proposal is experimental and that the work is to some extent of a pioneer nature.

With regard to women occupiers of land, the view is strongly urged that British settlers desiring to take up farms should in every case seek employment as wage-earners upon the land in the locality in which they propose to settle for a period of at least one year, preferably two, before they decide upon purchase. It is further suggested that the winter season might usefully be employed by the women in undergoing a five months' course at one of the Canadian agricultural colleges.

The delegates desire to draw attention to the following principles, which they consider should be observed in settling women on the land in the Dominion :—

1. That the women should work as joint owners, in groups of two or three rather than as single occupiers.
2. That holdings taken up should be of such size and class of cultivation as would admit them being worked by the owners without the necessary assistance of hired men.
3. That the cultivation of produce of first-class grade only should be the aim of women farmers.
4. That agriculturists should be of robust physique.
5. That it is of vital importance that a knowledge of business methods as well as of practical farming should be acquired before purchasing land.

The Annapolis Valley in Nova Scotia, the southern parts of Ontario, and the Kootenay, Okanagan, Chilliwack and Fraser Valley districts of British Columbia are recommended as most desirable for women farmers, and the types of cultivation considered most suitable are dairy, fruit (especially soft varieties), poultry, pigs, bees, vegetables and flowers.

Emphasis is laid upon the fundamental differences between the conditions of farming in Canada and in Great Britain, especially with regard to the lack of paid labour and its effect upon the life of women in the Dominion. Each settler must

be prepared to be more self-reliant and resourceful than is the case in England, and must realise that domestic duties performed either for her own household or that of her employer are an essential part of every women's life in Canada.

With reference to the article on "Drainage Operations in Norfolk," which was published in the issue of this *Journal* for July last, p. 381, the two pairs of photographs here reproduced show the state of the River Waveney before and after the drainage operations on this river described in that article. The photographs were taken, one pair (Figs. 1 and 2) about half a mile below, and the other pair (Figs. 3 and 4) about half a mile above, the bridge at Scole which carries the Ipswich to Norwich road across the Waveney.

The river in this neighbourhood was in the worst state of any with which the Norfolk Agricultural Executive Committee had to contend. The shoals were continuous, leaving only a narrow watercourse, and in places the sedges were in full growth right across the stream; the opening of a narrow way through the centre of these sedges was the first step in the operations.

At the Harper Adams Agricultural College a new feature is being introduced in connection with the 1919-1920 Egg Laying Trials which commenced last month.

**Egg-Laying Trials
at The Harper
Adams Agricultural
College.**

Hitherto, these trials have only appealed to the breeders of pure utility stock, and, interesting as the information obtained has been, its appeal has been necessarily limited. In the new trials a section is being reserved for breeders of exhibition stock, and in this section the leading breeds will be well represented. Another feature will be the extension of the single-bird test, which, while well known in Australia, has hitherto made no headway in this country. During the 1918-1919 trials at the Harper Adams Agricultural College a number of specially-designed pens were allotted to individual birds, and some remarkable figures have been recorded, several of the birds producing 260 eggs during the period of the trials.



FIG. 1.—River Waveney, above Scole Bridge. Before the cleansing.



FIG. 2.—River Waveney, above Scole Bridge. After the cleansing.



FIG. 3. —River Waveney, below Scole Bridge. Before the cleansing.



FIG. 4. —River Waveney, below Scole Bridge. After the cleansing.

THE National Utility Poultry Society, in conjunction with the Great Eastern Railway Company, carried out an egg-laying test at Dodnash Priory, Bentley, near Ipswich, over a period of 48 weeks which ended 2nd October, 1919. In all, 134 pens were entered for the competition, and were divided into five sections: (1) White Leghorns; (2) White Wyandottes; (3) any sitting breed (other than White Wyandottes); (4) any non-sitting breed (other than White Leghorns); (5) a championship section for White Leghorns and White Wyandottes, limited to breeders who had won one gold or two silver medals in previous tests. The eggs laid were classified by the Society into two grades: (1) Grade I., eggs weighing 2 oz. and over, and (2) Grade II., eggs weighing less than 2 oz. but not less than $1\frac{5}{8}$ oz. during the first 10 weeks and for the subsequent period not less than $1\frac{3}{4}$ oz. For the purposes of the competition, however, not more than 100 second-grade eggs, or, in the case of the championship section, not more than 200 second-grade eggs, were allowed to be included in the pen-score.

A table showing the egg totals for the test for the whole of the period is given below:—

Egg Totals for the whole Period of the Test.

Died during Test.	No. of Birds.	Breed.	Eggs Laid.			Average Yield per Bird* for 12 months.
			Grades.		Total.	
			1st.	2nd.		
15	335	White Leghorns ..	48,686	7,501	56,187	160
5	225	White Wyandottes ..	29,113	5,808	34,921	151
1	14	Light Sussex ..	1,653	279	1,932	129
1	35	Rhode Island Reds ..	4,757	669	5,426	155
1	25	Buff Plymouth Rocks ..	3,101	501	3,602	144
1	5	White Orpingtons ..	748	56	804	161
1	5	Buff Orpingtons ..	717	77	794	158
1	19	Anconas ..	2,913	141	3,054	153
1	29	Black Leghorns ..	3,404	101	3,505	117
3	2	White La Bresse ..	316	167	483	97
26	694	All the birds ..	95,408	15,300	110,708	155
		Unrecorded eggs ..	..	..	1,206	
		Under-weight eggs (excluded) ..	..	..	248	
		Total ..			112,162	

Including birds which died during the Test.

The egg production of the four leading pens in each section is shown in the following table:—

Breeds.	Pens.	Total Eggs per Period.			Test Score Value.	Average Yield per Bird for 12 months.
		1st.	2nd.	Total.		
<i>Section 1.</i>						
White Leghorns . .	1	878	108	986	978	197
	2	831	147	978	931	196
	3	858	45	903	903	181
	4	802	272	1,074	902	215
<i>Section 2.</i>						
White Wyandottes	1	860	99	959	959	192
	2	857	142	999	957	200
	3	854	70	924	924	185
	4	784	161	945	884	189
<i>Section 3.</i>						
Rhode Island Reds	1	820	59	879	879	176
	2	824	35	859	859	172
	3	836	18	854	854	171
Buff Rocks . . .	4	720	103	823	820	164
<i>Section 4.</i>						
Anconas . .	1	837	17	854	854	171
	2	767	12	779	779	156
	3	673	43	716	716	143
	4	636	69	705	705	141
<i>Section 5.</i>						
Championship White Leghorns	1	1,727	308	2,035	1,927	204
	2	1,780	126	1,906	1,906	191
	3	1,784	75	1,859	1,859	186
	4	1,682	128	1,810	1,810	181

The pens consisted of 5 pullets, except in the case of the championship section, where there were 10 pullets to the pen.

INQUIRY is made from time to time as to the position and prospects of the flax industry in England. The following facts will give the desired information.

**The Position of the
Flax Industry in
England.**

1. 12,363 acres of flax were grown under contract with the Board of Agriculture in 1918, and 12,568 acres in 1919. This flax was grown for *fibre* and should not be confused with the La Plata variety of flax, which is raised entirely for seed purposes. A large number of farmers and landowners grew linseed during last summer for feeding purposes, and this crop is becoming more popular every year. The straw of this variety

of flax is of very little value and is useless for fibre purposes, as it is too short and spreads out into numerous branches. On the other hand, the seed from *fibre* flax is almost as valuable for feeding as is ordinary linseed. Broadly speaking, the only flax grown for fibre in this country is that which is grown under contract for the flax factories of the Board of Agriculture and for the Yorkshire Flax Company.

2. The acreage of flax grown for fibre is regulated by the capacity of the factories which are available to deal with the straw produced. The above-mentioned figures are the maximum amounts which can be handled under present conditions by the existing factories of the Board.

3. The Flax Production Branch of the Board is producing flax in five different districts, namely, Somerset, Selby (Yorks), Peterborough, Suffolk and Fife. The factories in these areas are now offered by the Board for sale to private enterprise, the opinion having been formed that under such conditions the enterprise is most likely to be commercially successful. Having regard to the very high prices of flax at the present time, the undertaking may be exceedingly profitable. It is useless to encourage farmers to grow flax for fibre unless they are within easy reach of a factory that can carry out the retting and scutching operations, for which a large plant is required. Flax straw is so bulky that its carriage from a farm to a distant factory would largely absorb any profit arising from its sale.

4. Flax growing is undoubtedly a rural industry of great importance, and it is likely to remain so for some years to come. It is improbable that any large quantities of flax will be procurable from Russia for a long time; indeed, it is stated that in many parts of Russia the peasants have eaten all the flax seed. The flax factories of the Board are now turning out a considerable quantity of seed and fibre, but their output remains restricted owing to delay in the completion of the necessary machinery.

THE steps taken by the Middlesex County Council to deal with the problem of the destruction of rats in their county well

**Destruction of Rats
in Middlesex.**

deserve the attention of similar bodies in this country who, under the Rats and Mice (Destruction) Act, 1919 (which on the 1st January will supersede the existing Orders issued under the Defence of the Realm Act), will have to adopt similar measures for keeping under control the ravages

of these pests. In response to appeals made by the Board and under powers conferred on Local Authorities by the Rats Orders, the Council resolved to take vigorous measures to check as far as possible the depredations of rats in their county, especially in the localities where it was known that rat infestation had become a source of great trouble. A superintendent rat-officer and two assistants were appointed, and commenced their work in August, 1918.

Prior to the appointment of rat-catchers notices were posted throughout the county, inviting the public to apply for advice or assistance in this matter. Many such requests were received, and these have provided more than enough work to keep the staff fully employed, and to give some idea of the magnitude of the problem.

Some of the trouble was reported from shops or dwelling-houses where there was some defect in drain connections, or in householders' methods of storing food or dealing with refuse. Trouble was also reported by groups of allotment holders at Brentford, Southgate, Tottenham, Uxbridge, Willesden and Wood Green; at Ealing, especially at food shops and stores; at knackers' yards, piggeries, &c., at Tottenham; the work-house at Isleworth; Runemede rifle range; Acton, especially near the sewage disposal works; Golder's Green and Hendon, especially near the River Brent; and Ruislip, especially in the neighbourhood of the Royal Air Force stores. Larger questions of policy were raised by reports of rat infestation due to uncultivated streams, or to the failure of District Councils to burn their refuse.

In nearly every case, poison was supplied or laid. Much success attended the use of a preparation of squills, which is not ordinarily injurious to human beings or domestic animals, and is cheaper than the well-known proprietary poisons. Every precaution was taken to guard against accidents, by giving printed directions to persons supplied with rat poison, and obtaining a signed consent from those on whose premises poison was laid. On second visits it was found that householders generally were enthusiastically grateful and pleased with the results of the rat-catchers' work.

Formal notices under the Rats Order, requiring owners or occupiers of property to take steps to prevent rat infestation, were served in five cases up to 30th October last.

The Council consider that only the fringe of the problem of rat destruction has possibly so far been reached, and that to get at the root causes of the trouble organised and thorough

action is necessary. With this view new steps are being taken to get into closer touch with the military authorities and with organisations of farmers and allotment holders, while the best means are being considered of dealing with the difficulties presented by such breeding places as sewage works and refuse dumps, and infested areas around certain streams. Arrangements have been made for the superintendent rat-officer to attend meetings of agriculturists and of local agricultural committees in the county.

It is on such efforts as have been undertaken by the Middlesex County Council that the success of the campaign now urged upon the public for the destruction of rats must very largely depend. Thorough, well-organised and continuous action is essential. It should be emphasised, however, that it is most desirable, from every point of view, that the measures taken by Local Authorities to secure the enforcement of the Act should, as far as possible, be on self-supporting lines, and that where they undertake the destruction of rats on the premises of private occupiers, the cost should be borne by the individuals benefited and not by the general body of taxpayers.

During "Rat Week," the fourth week in October, the Middlesex County Council secured the co-operation of societies of allotment holders, of sanitary inspectors, of district councils, of the staffs of certain hospitals and work-houses, and of many commercial firms and private residents, to all of whom squill poison was supplied in considerable quantities and with excellent results.

It has been decided that the second National Rat Week shall open on Monday, the 29th December. It may seem to some that this date comes awkwardly in relation to the Christmas

Rat Destruction. holidays, but it will appear well chosen if it is remembered that if all goes well, the Rats and Mice (Destruction) Bill will come into force on 1st January. It is desirable to give those who, for any reason have found themselves unable to join in concerted action against rats, a further opportunity of doing so before the law substitutes a command for a request. Enough has been said, perhaps, to bring home to most thinking people the necessity for united action. The October Rat Week may be said to have proved quite clearly that where action is sporadic those who take no part in it are the real sufferers, because the hunted rat seeks sanctuary in the nearest district that is not taking action. The lessons of the first

week have been taken to heart by many of our leading Medical Officers of Health and a large number of the Local Authorities. It remains now for the others to join in, and it is hoped that the Scottish Authorities will unite on this occasion with England and Wales.

The Rats of a Great City.—Reports now coming in from some of the big cities that have made their first attempt to handle the rat problem are very illuminating. One great manufacturing centre has sent a report from which the few following extracts have been taken. Apparently this city relies largely upon the services of dogs and cats. In one butcher's shop 70 traps were set and 54 rats taken in a night. In another butcher's shop traps were used, but they cannot abate the nuisance. The owner of some stables reports that a rat-catcher caught 47 rats on his premises in one evening. Another stable owner writes that the rat-catcher caught 90 in one visit, and a third says it is not unusual on a calm summer night to see two or three rats in the street near his premises eating corn which has fallen from the nosebags of horses. A culverted part of a certain river passes in proximity to some infested premises, with the result that all attempts at rat destruction are useless. One café in a fairly prosperous part of the town is reported to be full of rats, but no action has been taken. The manager of a large firm says: "There are hundreds of rats about this building; rat-catchers have tried to deal with them many times without success. I am anxious to join any scheme, and within reasonable limits money would be no object if rats could be cleared out." From another café in a prominent street comes this message: "Greatly troubled with rats in kitchen and store room; rat-catcher and traps seem to do no good." Other statements in the report read, "These premises are infested with rats," and "premises overrun with rats; have used Virus without success." This city provides an instance of enormous damage by dangerous vermin, and to meet this damage—it probably runs into many thousands of pounds—it is stated that "The expenses incurred during Rat Week amounted approximately to £15." This relates to one of the wealthiest cities in England! The Medical Officer reports: "From information obtained, it would appear that in certain parts the rat problem is very serious, and in many instances occupiers and owners of premises would very willingly have joined in the concerted attack on rats and met the expense incurred if there were a fair chance of clearing their property . . . some occupiers were a little apprehensive at the measures they might be asked to take if they said their premises were infested." It is hoped that when the next Rat Week comes round all concerned will unite in an effort to remove the reproach from a great city.

Rat Destruction in Bournemouth.—One of the best statements yet to hand comes from the county borough of Bournemouth. Mr. W. G. Cooper, the Chief Sanitary Inspector, has accomplished his task in a fashion that many would do well to imitate. The borough of Bournemouth was divided into four districts, and a rat-catcher with an assistant appointed to each. Nine dogs and 20 ferrets were part of the equipment, and many hundreds of rats were killed. They were not merely killed, but were examined and less than 1 per cent. showed signs of ill health. Very interesting, too, is the statement that, while in one range of piggeries there were about nine does to every one buck, only seven

out of 79 rats killed were males. Five does out of every eight were with young or in milk, so it will be seen that the work of destruction was done at a very opportune moment. Nearly 3,000 poison baits were put down on private premises, and many others were put down in public places. Of all these baits about two-thirds were taken. Gins and traps and gas were not successful. In addition to these important results, Mr. Cooper observed that some rats live a good distance away from the places they frequented when in search of food. Bournemouth proposes to carry on the work of rat destruction, and it is satisfactory to learn that, in spite of the poison baits supplied, no single complaint of any annoyance due to their use has been received.

Rat Destruction at Poplar.—The Medical Officer of Health for the Metropolitan Borough of Poplar carried out the campaign against rats very thoroughly, choosing carbonate of barium for poisoning. To this was added an equal weight of tallow, and the two were mixed with dripping to a thick paste. This was warmed before a fire and spread on bread, which was cut to the size of dice. The baits were put down wherever vermin had been in evidence, with the result that in some places rats have disappeared entirely, and in other places they are disappearing. So greatly are business men and private householders of Poplar pleased with the work done that they are continuing it in the hope of putting an end to the activities of rats in their borough. Very few dead rats have been found, and the Medical Officer of Health is of opinion that poisoned rats either go back to the sewers to die or are eaten by other rats.

As the public are now well aware of the importance of rat destruction, and are convinced that efficacious methods can be employed, a great extension of the voluntary work may be seen before the Rats and Mice (Destruction) Bill becomes Law at the beginning of the New Year.

WITH this issue of the *Journal* is published a Supplement (No. 19) entitled "Reports on the Keeping and Carriage of Milk in Ventilated and Unventilated Milk Churns Respectively" (price, 6d. post free, from the Secretary, Board of Agriculture and Fisheries, Publications Branch, 3, St. James's Square, London, S.W. 1).

It may be said that up to comparatively recent times it was the universal custom to provide railway milk churns with very free ventilation, and it was often the case that the system of ventilation employed did not adequately protect the contents of the churn against contamination during transit.

The frequent arrival of milk in bad condition at its destination called into question the necessity for any ventilation apertures whatever, and led also to inquiries whether an improvement might be effected if filtered air only were admitted to churns during transit.

For these reasons the Board decided that a useful purpose would be served if these matters were carefully examined, and accordingly the authorities at the Dairy Research Station at Reading were asked to undertake an inquiry.

The Supplement in question gives an account of the results of that inquiry.

Wart Disease in Potatoes.—Replying to a question by Sir Beville Stanier, the Parliamentary Secretary to the Board stated that the number of cases of wart disease in potatoes up to 1st November was 22,222, and that there was an increase in the number of cases of the disease. (18th November, 1919.)

**Replies to Questions
in Parliament
affecting Agriculture**

Poultry.—In reply to a question by Major E. Wood, the Parliamentary Secretary to the Board stated that the Board were establishing a special Branch to deal with poultry-keeping, and in the selection of the staff the importance of expert qualifications would be fully recognised. The Board were also encouraging the appointment, by County Agricultural and Horticultural Committees, of poultry instructors, of whom 44 had already been appointed. The chief duty of these officers would be to encourage to the fullest extent the development of the poultry industry in every part of the country. (18th November, 1919.)

Cost of Milk Production.*—In reply to a question by Mr. Hurd, Mr. Roberts stated that the items included in the producer's price of 2s. 9¹/₂d. per gal. of milk during the seven winter months, on which the maximum retail price of 1s. per quart during five of these months is based, have been estimated in the following proportions:—

	<i>Per cent.</i>
Feeding stuffs	63
Labour	15
Rent, depreciation, and repairs	12.5
Cartage to producer's railway station .. .	1.5
Producer's margin, including interest and managerial expenses	8

The wholesaler is permitted an average maximum margin, out of which railway charges are paid, of 5d. per gal., and the retailer's average maximum distribution is 8d. per gal., the average retail price being accordingly 3s. 10¹/₂d. per gal. for the seven months in question. He pointed out that the price of 1s. per qt. was not a fixed price but a maximum price; this consideration applies equally in the case of the producer and the wholesaler. (18th November, 1919.)

Superphosphate.—In reply to a question by Mr. Harry Hope, the Parliamentary Secretary to the Board stated that arrangements had been made for the importation of phosphate rock from Algiers and Tunis which would bring up the total deliveries from these countries to the United Kingdom to 277,000 tons during 1919. Arrangements had also been discussed with the French authorities for the delivery of a substantially larger quantity during 1920. (3rd December, 1919.)

* See also Note on p. 935.

Diseases of Animals.—In reply to a question by Sir Beville Stanier as to the number of cases of anthrax, glanders, swine fever, sheep-scab, mange, rabies, and foot-and-mouth disease reported up to date this year and the corresponding figures for 1918, the Parliamentary Secretary to the Board supplied the following tabulated figures:—

Disease.	45 Weeks to 8th November, 1919.		Corresponding Period in 1918.	
	Outbreaks confirmed.	Animals attacked.	Outbreaks confirmed.	Animals attacked.
Anthrax	191	249	211	243
Foot-and-Mouth	66	2,686†	3	40†
*Glanders (including Farcy)	22	58	29	85
Parasitic Mange	4,400	8,784	3,789	7,090
Rabies	—	151‡	—	59‡
Sheep-Scab	273	—	274	—
Swine Fever	2,018	938	1,231	510

* Number of animals slaughtered as diseased or exposed to infection.

† Excluding outbreaks in army horses.

‡ Cases confirmed.

(12th November, 1919.)

Agricultural Executive Committees (Staff).—Replying to a question by Mr. A. Henderson, the Parliamentary Secretary to the Board stated that the numbers and cost of the staff employed by Agricultural Executive Committees in England and Wales, as reported by those Committees on 1st November, 1919, were as follows:—

Number of staff	905
Total salaries and wages of staff	£115,646
Estimated annual expenditure on travelling and subsistence allowances to staff	18,560
Total annual expenditure	£134,206

He stated that these figures represent a reduction of some 70 per cent. on war standard, both in respect of numbers and cost of the staff employed. (20th November, 1919.)

Agricultural Organisation Society.—In reply to a question by Mr. Waterson, the Parliamentary Secretary to the Board stated that, apart from grants for allotment and other special work, grants to the Agricultural Organisation Society are made from two sources—the Development Fund and the Small Holdings Account, much the larger proportion coming from the former. The Treasury have paid to the Society £20,000 during the current year on account of grants proposed from the Development Fund; and he understood that the Development Commissioners would probably recommend the Treasury to make to the Society grants for the current and the three following years, which were expected, with contributions from the Small Holdings Account, to make up a total of £120,000 for the four years. After 31st March, 1923, it was not contemplated that any further grants would be made to the Society (which should by then be self-supporting), except, possibly, for allotment work falling outside the normal activities of the

Society, which the Society might undertake with the approval or at the request of the Government. He added that no part of these grants or of any income of the Society was or will be spent in trading, the Society being a purely propagandist and advisory body, and giving no pecuniary aid to trading societies. It was, of course, an essential function of the Society to promote trading, in the sense of organising and advising farmers' societies for co-operative trade. (26th November, 1919.)

OFFICIAL NOTICES AND CIRCULARS.

N.B.—The Orders mentioned in this section of the JOURNAL may usually be obtained at the price of 1d. each from H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2, and 28, Abingdon Street, London, S.W.1; 37, Peter Street, Manchester, and 1, St. Andrew's Crescent, Cardiff.

THE following Circular Letter (No. 8/T) was addressed to Local Education Authorities by the Board on 22nd November :—

SIR.— I am directed by the President of the **Permanent Pastures.** Board of Agriculture and Fisheries to inform you that while he confidently relies on farmers to maintain arable cultivation to the greatest possible extent, he is at the same time very anxious that production on both temporary and permanent pasture in England and Wales should be increased by the adoption of better methods of husbandry. With that object he would be glad if your Committee would review their arrangements for providing farmers with such technical advice and assistance as they may require and for stimulating effort in that direction. In particular I am to ask that the county agricultural staff may be instructed to devote special attention to this subject; if necessary the staff should be increased.

The work of effecting improvement falls mainly under two heads :—

- (a) The improvement of poor pasture and meadows by the use of fertilisers, appropriate mechanical treatment, and renovation with new seed, singly or in combination.
- (b) General guidance and advice in laying down land to grass.

The President is advised that under the first head improvement can be most effectively secured by the maintenance in various parts of the country of suitable demonstration plots. They should be on a scale sufficiently large to admit of the results being measured by actual pecuniary returns; they should, of course, be located in districts where there is the greatest need of advice and demonstration: they would require to be fenced, and in each case a suitable plan for manurial treatment should be devised. Lord Lee hopes that your Committee, if they do not already conduct an adequate number of such demonstrations as part of their scheme of agricultural education for the county, will take immediate steps to supply this need, and the Board are prepared to assist in drawing up plans for the purpose.

The President is of course aware that the shortage of fertilisers is a serious obstacle at present to the improvement of grass land, but he thinks that much might be done immediately by such means as those suggested in this letter to ensure that cow pasture produces food to its full economic capacity.

Since a portion of the land ploughed up during the War may revert to grass in the near future he is anxious that the national importance of adopting the best methods for laying it down should be appreciated, and that knowledge of those methods should be immediately available to every farmer who requires it. In most cases the existing county staffs will be able to give farmers general guidance and advice; but he proposes to make arrangements at once if possible for the appointment of special officers of the Board to confer with local authorities and agricultural organisers where problems of unusual difficulty arise or where the local staff is not adequate.

I am, etc.,

(Signed) A. D. HALL,

Secretary.

THE following Circular Letter was addressed to Local Authorities by the Board on 29th November :—

Rat Week.

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to the final paragraph of pamphlet D.R.2* (“Some Suggestions for Intensive Rat Destruction”), a further copy of which is enclosed herewith,† and to say that the dates which the Board suggest for the two supplementary Rat Weeks referred to therein are 29th December to 5th January and 23rd February to 1st March. Such information as has been received respecting the recent Rat Week indicates that much good has been accomplished, but any inroads made into the rat population will speedily be rendered nugatory unless further attacks are organised. Co-operation and co-ordinated measures are essential if these Rat Weeks are to be a success, and Lord Lee therefore hopes that strenuous efforts will be made in every locality by all concerned to ensure such a result; and, during the coming season when rats will not be moving about so freely, further to reduce so far as possible the large number of rats still causing preventable damage throughout the country.

I am to ask that your Local Authority will be so good as to forward as soon as possible after the completion of each of these Rat Weeks a concise report as to the result, quoting the above reference number and heading, and giving where obtainable actual figures as to destruction, and details as to the success or otherwise of the various poisons used.

It is expected that the Rats and Mice (Destruction) Bill, 1919, which is now before Parliament, will come into force on the 1st January next, and I am to point out that if really good work is done during the coming Rat Weeks the onerous duties before the Local Authorities and the obligations to be imposed upon the public generally, when the Bill becomes Law, will unquestionably be much alleviated.

I am, etc.,

(Signed) A. D. HALL.

* See this *Journal*, September, 1919, p. 628.

† Not here printed.

THE Government has recently acquired from Germany a quantity of potash salts in exchange for food, and arrangements have now been made by the Board of Trade, in conjunction with the Board of Agriculture, for its distribution for agricultural purposes. The arrangements announced previously in Leaflet F.P. 494/S. 1* have been somewhat modified, and the Fertiliser Manufacturers' Association Ltd., by agreement with the British Potash Company, has undertaken the sale for agricultural purposes on the terms and conditions set out below. The sales will continue to be made under the general direction of an official committee called the Potash Distribution Committee, on which the Board of Trade and the Departments of Agriculture for England, Scotland and Ireland are represented, together with trade interests.

It has been found necessary, owing to increased charges for delivery, to raise the prices set out in the preceding notice by 5s. per ton in respect of all deliveries made on and after 1st December ---

The following are the maximum selling prices which will be in force in respect of deliveries made on and after 1st December.

FOR SALES TO FARMERS, DELIVERED TO NEAREST RAILWAY STATION
IN GREAT BRITAIN IN LOTS OF NOT LESS THAN 4 TON
GROSS WEIGHT.

	<i>Price per ton net cash in bags of approximately 2 cwt. each.</i>		
	<i>£</i>	<i>s.</i>	<i>d.</i>
Potash Salts, 30 per cent. K_2O	12	15	0
Muriate of Potash, 80 per cent. KCl	20	17	6
Sulphate of Potash, 90 per cent. K_2SO_4 ..	23	7	6

Manure mixers, merchants, dealers and co-operative societies will be allowed a discount on these prices of 7s. 6d. per ton on potash salts and 10s. per ton on the muriate and sulphate of potash. In the case of sales to the Channel Islands or the Isle of Man the above delivered prices will include delivery f.o.b. British port.

The potash will be sold at the above basis prices, and a proportionate increase or decrease will be made for higher or lower quality as shown by analysis of a representative sample of each consignment. The potash will be sold at the above prices on gross weights.

In the event of a general increase in railway rates being sanctioned by the Ministry of Transport, a proportionate increase on the above charges will be made.

Farmers should place their orders without delay with their usual dealer or co-operative society.

Manure mixers, merchants, dealers and co-operative societies should send their orders to the Fertiliser Manufacturers' Association Limited, 155, Fenchurch Street, London, E.C. 3.

For sales of small quantities made *ex merchant's store*, the Board would regard as reasonable the following maximum additions to the price charged for 4-ton lots :—

<i>Quantity delivered.</i>				<i>Additional Price.</i>
1 ton and over	..	..	..	10/- per ton
2 cwt. and over	but less than 1 ton	..	..	1/- „ cwt.
1 „	„	„	2 cwt.	2/- „ „
28 lb.	„	„	1 „	3/- „ „
14 „	„	„	28 lb.	4/- „ „

In the case of sales for delivery to consumer's premises *ex merchant's* shop or store the cost of conveyance, charged at local rates, may be added.

NOTE.—No potash of a lower grade than 30 per cent. salts is available under the above arrangement, but licences are being granted to the Alsace-Lorraine Trading and Development Company, 54, Gresham Street, London, E.C. 2, for the importation of 20,000 tons in all of kainit (14 per cent. K_2O) and potash salts (20 per cent. K_2O). Farmers who wish to purchase potash of these grades should apply to their usual dealers.

THE Board are now dealing with the destructive disease of fruit trees and bushes known as "Silver Leaf." A new Order directs occupiers of any premises on which plum trees are growing to cut off and destroy by fire on the premises all the dead wood on each plum tree before the beginning of April of every year. Where the dead wood on the trunk extends to the ground, the whole tree, including the root, must be burnt. An occupier of premises on which trees are growing may also be required to cut off and destroy in like fashion the dead wood of any kind of tree whatsoever on which silver leaf fungus is visible. Any Inspector of the Board of Agriculture or the Local Authority may enter premises on which he has reason to suspect the presence of trees or bushes to which this Order applies. Penalties "not exceeding ten pounds" await those who fail to comply with the requirements of the Order or who obstruct or impede any Inspector in the exercise of his powers. It is common knowledge that the spread of "Silver Leaf" is a very serious menace not only to plum trees but also to other orchard and even ornamental trees.*

Fruit growers throughout England are likely to welcome the Order, and to realise that the future of their industry depends largely upon the efficiency with which its directions are carried out.

THE following Letter, which has been addressed by the Food Controller to a correspondent respecting milk prices, is reprinted from the *National Food Journal*, 12th November,

Milk Prices. 1919:—

"You complain about the high price of milk for the winter months. As Food Controller no one could possibly regret high prices more than I do, and particularly so in the case of milk. But what are the facts of the milk situation? I think they can be put quite briefly and quite clearly, and I would summarise them as follows.—

"1. The first fact I would emphasise is this: the prices fixed both for wholesale and retail sales are maximum prices, and there is nothing in the wide world to prevent sales below these prices. The primary

* See Leaflet No. 302, issued by the Board.

object of the maximum price in this, as in other commodities, is to protect the purchaser, whether he is a dealer or a consumer. Otherwise, dealers and consumers are in exactly the same position as they would be in a free market.

" 2. The main justification for the high maximum prices which have been fixed is the high costs of production and in particular of feeding stuffs and labour. Feeding stuffs on the whole cost over three times what they did in the pre-war period and they are responsible for well over half the total cost of production of milk. The wages of agricultural labourers are about three times the pre-war level, taking into account the reduction of working hours. Agricultural labourers before the War were admittedly paid exceedingly low wages. Consumers must realise that the price they are paying to-day for milk is largely accounted for by these factors, and in particular by the improvement in the economic position of agricultural labourers. The notoriously low wages of agricultural labourers before the War can rightly be no longer tolerated.

" 3. The production of milk is such a sensitive thing that I have almost an impossibly difficult task in steering between problems of surplus and deficiency. In October there is always a surplus of milk, and this year, owing to the accident of weather, it is larger than usual ; but I have to think of mid-winter. Last winter there was such a serious shortage of milk that consumption had to be restricted by the Ministry. This difficulty may recur if the winter is severe. I cannot take any risks with the supply of milk.

" 4. If maximum prices had not been fixed for this winter, the public would almost certainly have had to pay substantially higher prices in the mid-winter months, though they might have paid lower prices in October and April. It appeared to me highly desirable to avoid large variations during the course of the winter.

" Let me emphasise that the maximum prices indicated do not interfere with the free play of supply and demand within the maximum. The effect of maximum prices is merely a protection against their rising above a defined level."

The Eastern Counties Commercial Fruit Show was held at Cambridge on the 4th and 5th November. Although this was the first show on

**Exhibits of Fruit
and Vegetables.**

commercial lines held in the district, it proved extraordinarily successful, no fewer than 1,200 people paying for their entrance on the first day. The majority of the visitors were obviously closely interested in fruit-growing and appreciated the exhibits warmly. Much of the fruit shown was of good quality, but the packing in not a few instances showed a lack of knowledge of the best commercial methods. The great contrast between the well- and badly-packed lots was an object lesson, and many of the growers present went away with revised ideas of the importance of proper grading and packing. Demonstrations in grading and packing given continuously during the two days attracted large numbers of interested spectators. The educational value of the show was undoubtedly great.

Fruit and Vegetable Preservation.—The Report of the Board's Demonstrator, on the Dairy Show, shows that the Board's exhibit of preserved fruit and vegetables aroused great interest. It had been arranged to give four lectures daily, but the audiences were so large that it was found necessary to give five and six lectures a day. The Board have received many expressions of appreciation of the practical help given by their exhibits and lectures to persons interested in preservation, and several inquiries have been made by people from different parts of the country as to the possibility of the Board's exhibit being sent to their districts.

THE Food Controller has made an Order (No. 1,648), dated 18th November, 1919, entitled the Milk (Use of Churns) Order, 1919, to the effect that :—

The Milk (Use of Churns) Order, 1919.

1. A producer of or dealer in milk shall not, after 25th November, 1919, use, or permit to be used, any milk churn which belongs to any person other than himself for any purpose except for the collection or delivery of milk.

2. A producer of or dealer in milk shall not, after 2nd December, 1919, use any milk churn which belongs to any person other than himself for the collection of milk from or delivery of milk to any person other than the person to whom the churn belongs or keep in his possession any such milk churn except in either case with the consent of the person to whom the churn belongs.

3. A person shall not obliterate, deface, cover or alter any mark or name on any milk churn except with the consent of the person to whom the churn belongs.

4. For the purpose of this Order, the expression "milk churn" shall include any part of a milk churn.

The Milk Distribution (Emergency) Order, 1919, is revoked by this Order.

THE Food Controller has issued an Order (No. 1608), dated 7th November, 1919, which states that the maximum first-hand prices for cheese prescribed by the Notices issued under the British Cheese Order, 1917, dated 10th July, 1919, 12th August, 1919, and 8th October, 1919,* shall apply to cheese of the varieties set out in the Schedules to the first and last-mentioned Notices (except Ripened Stilton and Wensleydale Blue cheese) where delivery is made on or before 31st January, 1920, in the same manner as they apply to cheese where delivery is made on or before 30th November, 1919.

2. The Food Controller further prescribes by the Order the prices set out in the Schedule below as the maximum first-hand prices for the varieties of cheese therein mentioned and manufactured and delivered as therein specified.

* See notes published in this *Journal*, November, 1917, p. 910, January, 1918, p. 1140, April, 1918, p. 115, August, 1919, p. 558, and October, 1919, p. 756.

The Schedule.

MAXIMUM FIRST-HAND PRICES.

Variety of Cheese.	Manufactured between 1st November and 31st December, 1919 (inclusive), in Great Britain and Ireland, and delivered on or before 31st January, 1920.
	Per lb. s. d.
Dorset hand-skimmed (blue)	1 8½
Dorset separated (blue)	1 4½
Dorset separated (white)	1 3
All other whole-milk cheese (except Caerphilly and Ripened Stilton and Wensleydale blue cheese and any whole-milk cheese not exceeding 2 lb. weight uncut)	2 0
All other partially-skimmed cheese (<i>i.e.</i> , cheese containing at least 25 per cent. of fat in the dry matter)	1 6½
All other wholly-skimmed cheese (<i>i.e.</i> , cheese containing less than 25 per cent. of fat in the dry matter)	1 3

Variety of Cheese.	Delivered between 9th November, 1919, and 8th January, 1920 (inclusive). Manufactured in Great Britain and Ireland.
	Per lb. s. d.
Any whole-milk cheese not exceeding 2 lb. weight uncut, other than Caerphilly ..	2 2

In all cases prices are *ex* factory or *ex* farm. All these prices are subject to the following terms :-

For cash within 7 days, 2*d.* in the £ discount.

„ „ 1 month, 1*d.* in the £ discount.

LORD LEE OF FAREHAM, President of the Board of Agriculture, has sent the following letter, dated 26th November, 1919, to the Women of the Land Army :—

**Lord Lee's Message
to the Women
of the Land Army.**

“ The Women's Land Army will be demobilised on 30th November, and I cannot allow the officers and members to sever their official connection with the Board without expressing to them my warm and heartfelt thanks for the invaluable services they have rendered to agriculture and to the nation as a whole.

The War has furnished many inspiring examples of self-sacrifice and devotion to the country's cause, but none has been more conspicuous in that respect than the women who came to the help of the nation in its hour of need. Without the aid of women, the manhood of the nation could not have withstood the attacks of our enemies, and the Women's Land Army is entitled to a specially honourable place among the various bodies into which women were organised. In spite of lower wages than might have been obtained in other occupations, and in spite of the isolation and discomforts of farm life, they came forward in large numbers to take the places of the men who had to leave the land for the Army. In almost every kind of farm work they have proved themselves most efficient substitutes for men, and it is certain that the greatly increased production which was secured from the land during the War could not have been achieved without the help of the Women's Land Army.

I cannot omit a special tribute of admiration to the cheerfulness and spirit of comradeship which have been such conspicuous features of the Women's Land Army. In their attractive costumes--the most pleasing and workmanlike uniform produced during the War--and with their keen enthusiasm for their work, they have done much to brighten the country-side. I look forward with great hope to the continued influence and work of women in connection with the improvement of the social and material conditions of village life, and the practical experience of farm work which has been gained by the members of the Land Army qualifies them to give most valuable assistance in that direction.

I further hope that many of the Land Army girls will continue their work on the land after demobilisation, and that they will make a point of becoming members of the National Association of Landswomen, which is being formed to bind together all women workers on the land.

All ranks of the Land Army can look back with pride to their share in developing the home production of food during the War, and they may be assured that their self-sacrificing service will never be forgotten by the Board, by the Government, or by myself."

THE relation between the Board and Women's Institutes can perhaps best be understood by a brief account of the happenings that led to the establishment of these institutes

Women's Institutes.* in this country. The first Women's Institute was started in Ontario, Canada, in 1897, by a group of country women, and the success of the movement induced the Provincial Canadian Government to give it recognition and financial support. The Secretary to the Advisory Board of Women's Institutes in British Columbia (Mrs. Alfred Watt, M.A.) came to England in 1913 to interest public bodies in this country in the movement, and the first Women's Institute was started in September, 1915, under the auspices of the Agricultural Organisation Society, at Llanfair. As the work was not properly within the scope of the programme of the Agricultural Organisation Society, the Board of Agriculture, on the advice of Miss Meriel Talbot, C.B.E. (Head of the Women's Branch of the Board), offered to take over the propaganda part of the movement. This was in October, 1917, when there were already 137 institutes in existence. As a result

* An article on Women's Institutes was published in this *Journal*, October, 1918, p. 827.

of the organisation of the Women's Branch of the Board, rapid progress was made in the formation of new institutes. A special section of the Branch was devoted to this purpose, and by October last the number of institutes had grown to over 1,200. At the same time the National Federation of Women's Institutes developed, and both the Board of Agriculture and the Agricultural Organisation Society were represented on the Executive Committee, the Board providing office accommodation and clerical assistance. In October last the National Federation was asked to undertake propaganda work as well as the after-care of the institutes. The National Federation has received a grant from the Treasury for the current financial year, and this grant is to be diminished year by year and is to end in 1922, when it is hoped that the movement will have become self-supporting. The Board retain the organisation of Women's Institutes Schools at which the organisers are trained,

The Institutes at Work.—The institutes are doing much to increase the simple pleasures of country life and to stimulate production of the lesser agricultural and horticultural products, as the following instances, picked out at random, will serve to show. In Cambridgeshire four institutes combined to give a fête, the programme including folk-dancing, sports, a baby show, and a cheese-making demonstration. At Great Baddow, in Essex, there has been an exhibition of knitted "jumpers," hats, hand-woven scarfs and home-made biscuits. At Harlow, in the same county, there have been demonstrations of fruit drying and bottling, and an exhibition of members' work, which included upholstering, fancy work and home tailoring. At Netherhampton, in Hampshire, "a tiny village with only 121 inhabitants," the local institute has 31 members, and has purchased a fruit-bottling outfit and established a depot. At Chelmsford (Essex), the institute has a stall in the market and holds weekly sales, at which hundreds of pounds' worth of village produce has been sold. This brief note by no means exhausts the activities of these institutes, and it is abundantly clear that they are destined to play a very important part in the re-awakening of English rural life. It is significant that County Councils having examined the work done, are giving valuable assistance by providing lectures.

The Institutes and the Village Clubs Associations.—It must not be thought that Women's Institutes are working in any way to overlap the good work of the Village Clubs Association. On the contrary, the relations between the two are not only excellent but intimate. These relations are set out in a resolution agreed upon by the two bodies, the terms having been drawn up by the Development Commissioners in consultation with the Board. The resolution runs as follows:—

"A Joint Standing Committee, consisting of an equal number of representatives of each organisation, shall be set up and shall meet at frequent intervals with a view to the adoption of such measures as may be practicable and expedient for ensuring co-operation between the two organisations. Such co-operation to include the utilisation as far as possible of the constitutions of the two organisations for common purposes, to prevent overlapping, and the interchange of views and experience. The two organisations further agree to establish their headquarters under the same roof as soon as suitable accommodation can be found."

THE work of tractor ploughing by women was started in the autumn of 1917, at a time when farmers were strongly of opinion that women were quite unsuited to the task. To meet

**Women and
Tractor Work.**

these objections great care was taken in the selection and in the medical examination of recruits, while preference was given, where possible, to educated women. In the face of many difficulties and of a frank lack of confidence among their employers, the women tractor drivers "carried on" and "made good."

The Women's Land Army has now been disbanded, and the splendid record of the Women Tractor Service thus comes to an end. The following brief facts regarding their work, however, may be placed on record.

Four hundred and fifteen women were selected to receive training, and of these 400 were actually employed. The best teaching was done in the training centres, where an opportunity was afforded of studying the tractor mechanism, but it was necessary for some of the women to be taught in the field. The opinions of the Agricultural Executive Committees and of the tractor representatives throughout the country have been collected, and they constitute a record of which the women motor-tractor drivers have every reason to feel very proud. It may be remembered that some 40 Distinguished Service Bars have been awarded to the twenty odd thousand women of the Land Army. There are only 400 in the tractor service, but though they were not more than 2 per cent. of the Land Army, they took 25 per cent. of these honours.

Details of Awards.--*M. Kisielowski, J. Smith, and J. S. Thompson* (Berkshire) were awarded the D.S.B. for ploughing a difficult and dangerous piece of sloping ground which the men had refused to handle. They carried out their work successfully.

D. McCrae (Cumberland) was awarded the D.S.B. in recognition of exceptional skill and devotion to duty. She gained 100 per cent. in a tractor test, and with the aid of another girl ploughed a field that some soldier workers had refused to touch. She is now in charge of the tractor department of a firm of contracting engineers. Lord Lee of Fareham, President of the Board of Agriculture and Fisheries, has sent her a special message of appreciation.

B. Lewis (Flintshire), who had previously gained the Tractor Ploughing Prize for North Wales, was awarded the D.S.B. for stopping a runaway horse.

M. Garnet and W. Worthington (Kent) were awarded the D.S.B. for the excellence of their work and for breaking the county ploughing record; they ploughed more acres with the use of less petrol than any man similarly employed.

F. Bridgman (Lancashire) drove a motor tractor for 16 months, and during that period her weekly average was just double that of the men. At imminent danger to her own life she remained on an "Overtime" tractor which had got completely out of control on a very dangerous hill.

F. Brook (Lincolnshire) won the First Prize of £20 offered by the farmer employing her for the largest acreage worked with the lowest amount of fuel, the general condition of the tractor at the end of the period being taken into consideration.

K. May (Somersetshire) was awarded the D.S.B. for remaining at her work for a considerable time both as tractor driver and shepherdess, in an exceedingly lonely and inaccessible part of Exmoor.

M. E. Lennard (Wiltshire) was awarded the D.S.B. for winning the County Championship and breaking several records. During last harvest she cut over 120 acres of wheat in one week.

(Other awards of the D.S.B. were noted in the issue of this *Journal* for October, 1919, p. 755.)

THE following Circular Letter (No. C. L. 241/C. 6) was addressed to County Councils and Councils of County Boroughs in England and Wales by the Board on 11th November —

**Land Settlement:
Preference to
ex-Service Men and
Women.**

SIR,—I am directed to call the special attention of your Council to the fact that Section 11 (7) of the Land Settlement (Facilities) Act, 1919,* requires Councils in letting or selling any holdings prior to 19th August, 1921, to give preference to suitable men who have served at any time in the Forces of the Crown, and to suitable women who are certified by the Board to have been engaged in whole-time employment on agricultural work during a period of not less than six months during the War.

2. It is most important that Councils should comply strictly with this provision. There is naturally some impatience among ex-Service applicants at the inevitable delay in providing them with holdings, but this would develop into serious unrest if they found that holdings were being let or sold to non-Service applicants before the demands of the Service applicants had been met. The periodical returns being received by the Board indicate that in some counties the provision of the Act is not being followed as strictly as it should be.

3. Non-Service applicants are not altogether excluded from the benefits of the Land Settlement Scheme, but it must be distinctly understood that during the next two years their demands must come second to those of the ex-Service men and women.

4. Councils should, therefore, give instructions that no holding should be let or sold to any non-Service applicant until they have ascertained that the holding will not be taken by any of the suitable ex-Service applicants on the books of the Council. I am to point out that this applies not only to any new holdings established by Councils, but also to any of the holdings provided by Councils before the War which became vacant.

5. With regard to women applicants I am to say that before letting a holding to any woman the Council should ascertain whether the Board have issued a certificate in her favour under Section 11 (7) of the Act. In this connection it may be useful for your Council to know that during the War the organisation set up throughout England and Wales to deal with the employment of women on the land has collected a large amount of information not only with regard to individual members of the Women's Land Army and of other similar agricultural corps, but also with regard to a large number of local village women who undertook work on the land. The Board would be happy to arrange for any

* See note in this *Journal*, p. 735.

information of this kind now at the disposal of their Women's Branch and local organisation to be made available for the use of your Small Holdings Committee in respect of any woman whose application for a small holding may be under consideration by the Committee.

I am, etc.,

(Signed) LAWRENCE WEAVER.

THE following Circular Letter (No. C.L. 243/C. 6) was addressed to County Councils and Councils of County Boroughs by the Board on 18th November :—

Procedure for Purchase of Land for Perpetual Annuities by County and Borough Councils.

SIR,—I. I am directed by the President of the Board of Agriculture and Fisheries to refer to paragraph 7 of the Board's Circular Letter, 232/L. 6 of the 25th ult.,* and to say that the Board think it desirable to indicate, for the guidance of Councils, the procedure which should be adopted in any case where the Council propose to purchase land for perpetual annuities issued by the Council under Section 9 of the Land Settlement (Facilities) Act, 1919. That section authorises limited owners to sell in consideration of such annuities, and in the case of land belonging to a college, incumbent, charity, or other corporation, it is anticipated that this procedure will be found to be acceptable.

2. The annuities may be redeemed at any time by the Council on the basis of the average price of prescribed Government securities (see subs. (3) of Section 9). The annuities are charged on the county fund or borough fund or rate, and the receipts derived from the small holdings will be available for their payment. They will be registered securities, transferable by deed in any amount not less than one pound, and they are trustee securities.

3. The Regulations under paragraph 10 of the First Schedule of the Land Settlement (Facilities) Act, 1919, as to the mode of transfer of annuities, form of certificate, registration of stock, sinking fund for redemption, etc., are being prepared by the Ministry of Health and will be issued shortly, but as these Regulations do not affect the value of the annuities and will be issued before the completion of any sale which is now agreed upon, the Board see no reason why your Council should not at once proceed to negotiate for the purchase of land for annuities.

4. In any case in which the Council propose to purchase land by this means they should, in the first instance, obtain a valuation of the property in the same way as if they proposed to purchase for cash. When the Small Holdings and Allotments Committee have considered the valuation and decided upon what is, in their opinion, the capital value of the land, they should then calculate what that value represents in terms of a perpetual annuity. As a guide to your Council, the Board may state that in view of the fact that the annuity is a permanent one and an excellent security, they have not hitherto been prepared to sanction the purchase of land for annuities representing a higher rate than 5 per cent. on the capital value of the property. It would, how-

ever, be advisable for the Small Holdings and Allotments Committee to consult the County Treasurer with regard to the conversion of capital value of a property into terms of an annuity.

5 For the purpose of removing any doubt which may exist, I am directed to say that any annuity payable by the Council will form part of the Council's liabilities for the purpose of Section 27 (2) of the Land Settlement (Facilities) Act, 1919. The annuities and any sinking fund charge required by the Ministry of Health Regulations will also be regarded as equivalent to loan charges for the purpose of Section 27 (3) of the above-mentioned Act.

6. In view of the necessity for reserving the money which the Treasury had agreed to provide during the next two years for defraying expenditure which cannot be discharged by annuities, I am directed to press on your Council the desirability of utilising to the utmost their powers of purchasing for annuities. Though the procedure for the purchase by means of annuities is novel, the Board think that your Council should be able to adopt it to a considerable extent if they explain to landowners the security for the annuities and the facilities for realising the annuities when this becomes desirable.

7. If there is any further information which the Council may require with regard to procedure the Board will be happy to supply further particulars.

I am etc.,

LAWRENCE WEAVER.

Now that the employment of German prisoners of war on British farms has ceased, it may be of interest to give a brief account of the work performed by them, and of the conditions under which this work was carried out.

Employment of German Prisoners of War on the Land. Prisoners of war were first employed in agricultural work early in 1917. They remained throughout in the custody and under the control of the military authorities, who were responsible for the management and discipline of the camps in which the prisoners were housed and for the provision of guards. The work of the prisoners, the allocation of the labour, and the general handling of the whole scheme was in the hands of the Food Production Department of the Board of Agriculture, and was worked through the County War Agricultural Executive Committees. Parent camps were established and small agricultural camps formed from them in convenient places, as and where the Agricultural Executive Committees and the Department required the men.

The total number of prisoners allotted to the Food Production Department for agricultural work varied slightly from time to time, but in January, 1919, was 30,679. These prisoners were divided into four classes:—(1) prisoners working from depots: these were the most numerous class and were men sent out to the same farmer; daily, returning at night to the camp to sleep. (2) Scheme "B," which consisted of a limited number of prisoners having board and lodging with farmers who were responsible for their safe custody. (3) Prisoners working from parent camps. (4) Migratory gangs: these consisted of gangs of 10 prisoners, who were sent out in charge of a single guard to farmers who applied at a camp for a gang for special work.

At the beginning of September, when repatriation was decided upon, there were employed (1) 19,319 prisoners going out daily to work with farmers from 321 agricultural camps; (2) 1,735 prisoners boarded out with farmers under Scheme "B"; (3) 1,008 prisoners sent out from parent camps; and (4) 3,041 prisoners working in migratory gangs. The total number employed at that date was 25,103.

The general repatriation of prisoners was arranged to take place at the rate of 400 daily, but was seriously delayed by the railway strike. However, at the present time all prisoners working under Scheme "B" in migratory gangs and from parent camps have been repatriated. Over 200 of the agricultural camps have also been closed and some 15,000 of the men working from them have been repatriated to date, while the remainder are leaving from day to day as fast as circumstances will permit.

At first there was much prejudice amongst farmers against the employment of prisoners of war, but on the whole their work was very satisfactorily and efficiently performed. They were generally regarded as a valuable addition to the local labour in agricultural and drainage operations, and the fact that they were available during the 1919 harvest did much to meet the difficulties which arose in many counties owing to the withdrawal of the men in agricultural companies.

THE following Notice was issued by the Board on 29th November :—
Owners and prospective purchasers of thoroughbred stallions of hunter sire type will be interested to know that the

**Increased Premiums
for Stallions.**

Board of Agriculture will offer for award at the Show of Thoroughbred Stallions, which will be held at the Royal Agricultural Hall, Islington, on 2nd and 3rd March, 1920, sixty King's Premiums, as in previous years. In view, however, of the increase in the cost of keeping and travelling such stallions, an increase of £50 will be made in the amount of the Premium paid by the Board, and its average value next season will, therefore, be £350 instead of £300. Super Premiums, not exceeding twelve in number, will be awarded to selected King's Premium Stallions of exceptional merit. The Board's Premiums, *i.e.*, those awarded to stallions on the recommendation of the Horsebreeding County Committees, will also be increased in value by £50.

AMONG the replies which have been received from the representative farmers to whom the Circular Letter asking confidentially for information respecting the state of labour in agriculture was sent, a large number refer to the lack of

**Rural Housing
and the
Labour Question.**

sufficient housing accommodation as one of the most important. If the returns sent in are typical of the conditions which prevail in the country, it would appear that the trouble is most acute in the West Midlands (Division 3a), the next in order being the South-Western Counties (Division 3b), the Eastern Counties (Division 1a), and the

East Midlands (Division 2b). The effect of this shortage is shown in many ways. First, it is said in several quarters that it is impossible to get or keep the best kind of farm worker until more and better cottages are provided. Secondly, it is stated that it is impossible to get the extra men required to work the farms properly when they cannot be housed. Thirdly, if the hours of labour are further reduced, so that the employment of additional men would be indicated, it would be impossible to carry on, as without more cottages more men cannot be employed. Fourthly, the unsatisfactory housing conditions are responsible for discontent among the workers. Without increased cottage accommodation increased food production is impossible, or at least very difficult. (*Wages Board Gazette*, 15th November, 1919.)

THE Food Controller has issued an Order (No. 1706), dated 25th November, 1919, entitled The Potatoes Order, 1919, which formally

**The Potatoes
Order, 1919.**

revokes a number of potato Orders which were in force for the 1917-18 crops. The only restrictions which this Order places on the sale of potatoes (apart from export restrictions) are (a) dealers in potatoes must continue to be registered, and (b) sound ware potatoes may not be used for any purpose other than seed or for human food. The following Orders, with references to previous issues of this *Journal* in which they have been mentioned, are revoked by this Order :—

No. of Order.	Title of Order.	References in this <i>Journal</i> .
No. 949, as amended by Nos. 99, and 1155 of 1917 and Nos. 445 and 639 of 1918.	Potatoes Order 1917 ..	October, 1917, p. 765 ; December 1917, p. 1014 ; May, 1918, p. 209.
No. 979 of 1918 ..	Potatoes Order, 1918 ..	September, 1918, p. 740.
No. 63 of 1918 ..	Potato Bags Order, 1918	—
No. 1645 of 1918, as amended by Nos. 55 and 396 of 1919.	Potatoes (Consolidation) Order (No. 2), 1918.	May, 1919, p. 196.
No. 211 of 1918 ..	Potatoes (Protection) Order, 1918.	—
No. 555, as amended by No. 623 of 1918.	Potatoes (Registration of Wholesale Dealers) Order, 1918.	June, 1918, p. 349 ; July, 1918, p. 483.
No. 411 of 1918 ..	Potato (Restriction) Order, 1918.	—
No. 1438 of 1918 ..	Potato Committees Order, 1918.	December, 1918, p. 1115.
No. 1188 of 1917, as amended by No. 518 of 1918.	Potatoes Order (No. 2), 1917.	December, 1917, p. 1021 ; June, 1918, p. 349.
No. 534 of 1918 ..	Potatoes (Base Prices) Order, 1918.	June, 1918, p. 347.
No. 554 of 1918 ..	Early Potatoes (Prices) Order, 1918.	June, 1918, p. 348.

In view of the increased cost of production, the Board have reluctantly decided to raise the price of this *Journal* to 6d. per copy.

**Increased Price of
"Journal."**

The rates for new subscriptions received after 31st December, 1919, will, therefore, be as follows:—

		United Kingdom and British Colonies. (Post free.)		Foreign Countries. (Including postage.)
One year	.. ..	6s.	..	8s.
Six months	.. ..	3s.	..	4s.
Three months	.. ..	1s. 6d.	..	2s.

The increased prices only apply to present subscribers on the expiry of their current subscriptions.

Back numbers up to the December, 1919, issue, where still available, may, of course, be obtained from the Board at the published price.

The *Journal* may be obtained directly from the office of the Board (3, St. James's Square, London, S.W. 1), or through any Bookseller or Railway Bookstall.

PRELIMINARY STATEMENT, dated 6th December, 1919, showing the estimated total produce and yield per acre of the potato and root crops in England and Wales in the year 1919, with comparisons for 1918, and the average yield per acre of the ten years 1909-1918.

—	Crops.	Estimated Total Produce.		Acreage.		Average Estimated Yield per Acre.		Average of the Ten Years, 1909-1918.
		1919.	1918.	1919.	1918.	1919.	1918.	
ENGLAND AND WALES	Potatoes ..	Tons. 2,732,000	Tons. 4,209,000	Acres. 475,376	633,832	Tons. 5·7	Tons. 6·6	Tons. 6·3
	Turnips and Swedes ..	11,190,000	12,018,000	983,398	909,248	11·4	13·2	13·0
	Mangold ..	6,320,000	8,231,000	398,051	399,723	16·0	20·6	19·4
ENGLAND	Potatoes ..	2,571,000	3,987,000	446,341	596,607	5·8	6·7	6·3
	Turnips and Swedes ..	10,489,000	11,233,000	925,579	856,946	11·3	13·1	12·9
	Mangold ..	6,124,000	7,988,000	382,982	386,508	16·0	20·7	19·5
WALES ..	Potatoes ..	161,000	222,000	29,035	37,225	5·5	6·0	5·6
	Turnips and Swedes ..	781,000	785,000	57,619	52,302	13·2	15·0	15·3
	Mangold ..	196,000	243,000	13,089	13,215	15·0	18·4	18·0

NOTE.—The yield of *potatoes* this year amounts to 5·7 tons per acre, which is nearly one ton less than last year, and three-fifths of a ton less than the average of the last ten years. The total production amounts to 2,732,000 tons, which, although 1,477,000 tons less than in 1918 (by far the largest crop raised since official estimates were first collected in 1885) is only 190,000 tons less than the ten-year average, and is 50,000 tons more than the pre-war average. *Turnips and Swedes*, with 11·4 tons per acre, have yielded 1·8 tons less than last year and 1·6 tons less than the average. The total production, 11,190,000 tons, is 828,000 tons less than last year. The yield of *mangolds* amounts to 16 tons per acre, or 4·6 tons less than last year, and 3·4 tons below the average; this is the lowest yield since 1896. The total production, 6,320,000 tons, is 1,911,000 tons less than in 1918.

THE Food Controller has issued an Order (No. 1680), dated 22nd November, 1919, entitled the Pigs (Maximum Prices) Order, 1919, prescribing new maximum prices for pigs, and making certain amendments in the present regulations affecting the sale of pigs. The new maximum prices are as follow:—For live pigs sold otherwise than by dead weight, 23s. per score of the live weight; and for live pigs sold by dead weight and dead pigs, 30s. 6d. per score of the dead weight if the offals are included in the sale, and if the offals are not included in the sale, 29s. 3d. per score of the dead weight. The amount actually paid or payable for carriage may be added to the maximum price, but no other charges may be made for delivery. The maximum prices apply to all pigs, whether sold as stores or for slaughter, except pigs bought and sold specifically for breeding purposes, and those weighing at the time of sale less than 112 lb. live weight. The Order came into force on 1st December.

**New Maximum
Prices for Pigs.**

THE Board have issued a new edition of the Bound Volumes of Leaflets Nos. 1–100, 101–200, and 201–300. These Volumes, which are fully indexed, contain the latest editions of the Board's leaflets bound in a convenient form for reference.

**Bound Volumes
of Leaflets.**

Readers of this *Journal* who wish to obtain copies of the Bound Volumes should note that the price is now 1s. 6d. net each volume, or 4s. the three volumes, post free. Remittances, which should accompany the Order, should be sent in the form of postal orders, cheques, or money orders payable to the "Board of Agriculture and Fisheries or Order," and crossed "Bank of England."

THE position as regards the various districts in which Foot-and-Mouth Disease had appeared, noted in last month's issue of this *Journal*, is as follows:—

**Foot-and-Mouth
Disease.**

Warwickshire.—No outbreak of the disease having occurred since the 24th October, the remaining restrictions were withdrawn as from 6th December. On 15th December, however, the disease again appeared on the original Infected Place which had not in the interval been declared free. This outbreak has necessitated the re-imposition of the prohibition of movement over a small area around that place.

Huntingdonshire and District.—No outbreak having occurred since 1st November, all remaining restrictions were withdrawn as from 9th December.

Lincolnshire.—No outbreak has occurred since 6th November and the remaining restrictions were withdrawn as from 16th December.

Surrey.—The last outbreak was on 12th November, and the restrictions have been modified so as to apply only to a small area immediately surrounding the Infected Place.

Isle of Wight.—The twenty-fifth outbreak in the Island occurred on 24th November, but there have been none since that date. The

restrictions on movement now apply only to two small areas in the Island, but the export of animals from the Island to the mainland remains prohibited.

Durham.—A fresh outbreak was confirmed at Great Lumley, near Fence Houses, on 12th December, and an Order was made prohibiting movement over a wide area surrounding the infected premises. Provision has, however, been made for movement of fat stock into the boroughs for slaughter.

SINCE the note published in last month's issue of the *Journal* (p. 849), 4 more cases of Rabies have been confirmed in Great Britain,

Rabies. 1 in Buckinghamshire on 14th November, 1
 in Oxfordshire on 24th November, 1 in
 * Glamorgan on 8th December, and 1 in Kent
on 11th December, bringing the total for the whole country up to 253.

The cases in Buckinghamshire, Oxfordshire, and Kent were not within any existing muzzling area, and have consequently necessitated the imposition of Orders applying muzzling and movement restrictions over two new areas of considerable size in those counties.

MISCELLANEOUS NOTES.

THE *International Crop Report and Agricultural Statistics* for November, 1919, published by the International Institute of Agriculture, gives particulars concerning the production of the cereal crops of 1919 in certain countries in the Northern Hemisphere.

Notes on Crop Prospects and Live Stock Abroad.

Wheat.—The production in Spain, France, Great Britain, Italy, Netherlands, Rumania, Switzerland, Canada, United States, British India, Japan, and Tunis is estimated at 254,989,000 qr. in 1919, against 273,674,000 qr. in 1918, or a decrease of 6·5 per cent., the area sown showing a decrease of 0·4 per cent.

Rye.—The estimated production in France, Spain, Italy, Netherlands, Rumania, Switzerland, Canada, and the United States is placed at 19,992,000 qr. in 1919, or a decrease of 4·1 per cent. compared with 1918, when it amounted to 20,850,000 qr., but the area sown shows an increase of 5·4 per cent.

Barley.—The production in Spain, France, Great Britain, Italy, Netherlands, Rumania, Switzerland, Canada, United States, Japan, and Tunis is estimated to amount to 65,992,000 qr. in 1919, against 73,900,000 qr. in 1918, or a decrease of 10·7 per cent., the area sown being smaller by 4·7 per cent.

Oats.—It is estimated that the total yield in Spain, France, Great Britain, Italy, Netherlands, Rumania, Switzerland, Canada, United

States, Japan, and Tunis amounts to 213,865,000 qr. in 1919, against 255,159,000 qr. in 1918, or a decrease of 16·2 per cent., the area sown being smaller by 3·5 per cent.

Maize.—The production in Spain, Italy, Rumania, Switzerland, Canada, and the United States is estimated at 364,617,000 qr. in 1919, against 317,614,000 qr. in 1918, or an increase of 14·8 per cent., while the area sown shows a decrease of 3·3 per cent.

Belgium.—The preliminary estimates of the production of the cereal crops in 1919 are as follows (the average yield in the three years 1912–1914 being shown in brackets) :—Wheat, 1,236,000 qr. (1,837,000 qr.) ; rye, 1,596,000 qr. (2,601,000 qr.) ; barley 434,000 qr. (508,000 qr.) ; oats 2,760,000 qr. (4,538,000 qr.).

Rumania.—H.M. Representative at Bucharest reports that the production of the corn crops this year in the old kingdom of Rumania is officially estimated as follows, in quarters (the average of the years 1911–15 in brackets) :—Wheat, 6,036,000 (9,797,000) ; rye, 428,000 (414,000) ; barley, 1,424,000 (3,125,000) ; and oats, 1,716,000 (3,300,000).

United States.—The Bureau of Statistics of the Department of Agriculture gives the following final estimates of the crops harvested in 1919 in the United States, in bush. (1918 figures in brackets) :—Winter wheat, 731,640,000 (558,449,000) ; spring wheat, 209,350,000 (358,651,000) ; total wheat, 940,990,000 (917,100,000) ; oats, 1,248,300,000 (1,538,359,000) ; maize, 2,917,500,000 (2,582,814,000) ; barley, 165,720,000 (256,375,000) ; rye, 78,478,000 (89,103,000) ; linseed, 8,919,000 (14,657,000). (*The London Grain, Seed and Oil Reporter*, 12th December, 1919.

Live Stock in the Netherlands.—The numbers of live stock in March, 1919, were as follows (the corresponding numbers in August, 1918, being shown in brackets) :—Horses, 362,011 (378,294) ; cattle, 1,968,609 (2,048,872) ; pigs, 449,829 (600,133). (*International Crop Report and Agricultural Statistics*, November, 1919.)

Live Stock in New Zealand.—The numbers of live stock on the 31st January, 1919, were as follows (the corresponding numbers on the 31st January, 1918, being shown in brackets) :—Horses, 363,902 (378,050) ; cattle, 3,021,781 (2,869,465) ; pigs, 235,222 (258,694). The number of sheep and lambs on the 30th April, 1919, was 25,828,554 against 26,538,302 on the 30th April, 1918. (*International Crop Report and Agricultural Statistics*, November, 1919.)

THE monthly crop report of the Board on 1st December was as follows :—Over most of the country the weather of November was very favourable to autumn cultivation and sowing,

Agricultural Conditions in England and Wales on 1st December. the exception being the north-eastern counties, where frost and snow, followed by wet weather, seriously interfered with the work, while in Wales and a few other localities there were stoppages of longer or shorter duration.

Except in the north-east, therefore, where the position is not far from normal, autumn work is considerably more advanced than usual at this time of the year.

The cold weather has generally caused germination of the winter corn to be slow, but where showing it is a satisfactory plant, more especially that sown early. It is estimated that about three-fourths of the area intended for wheat has now been sown, and that the area already actually seeded is about the same as on the 1st December last year; but the season was then more backward. Of other winter corn about the same area as last year has now been sown.

Potatoes have practically all been lifted under very favourable conditions; the crop is (except in the extreme south-western counties, where disease is reported to be rather prevalent) sound, and unusually free from disease. The tubers are, however, small; and the total production in England and Wales, from an area of 475,000 acres, amounts to 2,732,000 tons, being at the rate of 5·7 tons per acre, or three-fifths of a ton below the average.

Mangolds have nearly everywhere been clamped, though some fields here and there are reported not to have been pulled yet; there is not much mention of damage by frost. Turnips and swedes are now being generally raised wherever it is not intended to feed them on the ground. Roots generally are sound and in very good condition. The yield has been small. Mangolds have yielded 16 tons to the acre, nearly 3½ tons below the average, and the total production, 6,320,000 tons, is nearly 2,000,000 tons below last year. The total production of turnips and swedes is estimated to be 11,190,000 tons, or at the rate of 11·4 tons to the acre—some 800,000 tons below last year. As the yield of hay was also very light—about 5,200,000 tons—there is thus a shortage of all the three principal kinds of winter feeding stuffs, and farmers will have to exercise the greatest care to make them last through the winter. Compared with the past ten years, there is a shortage in England and Wales of nearly 2,000,000 tons of mangolds, over 2,000,000 tons of turnips and swedes, and nearly 2,500,000 tons of hay. Barley is also 300,000 quarters less than usual, but owing to the increased acreage there are fully 800,000 more quarters of oats.

Live stock, owing to the very cold weather and generally bare condition of the pastures, have only done moderately well during the month. They have been brought in from the fields, and farmers have been obliged to break into the scanty supply of winter foods, earlier than usual.

Ordinary farm labour has been everywhere sufficient, and in some cases plentiful; skilled labour, however, is still mostly scarce, although complaints on this ground are beginning to be less numerous than of late.

The following local summaries give details regarding agricultural labour in the different districts of England and Wales during November:—

Northumberland, Durham, Cumberland and Westmorland.—The supply of labour is about sufficient, and some men remained unhired at the Martinmas hirings. Here and there certain classes of labour are scarce.

Lancashire and Cheshire.—Except on the eastern side of Cheshire, where labour is scarce, the supply of labour is equal to the demand.

Yorkshire.—Skilled labour is occasionally scarce, but in most districts the supply of labour is sufficient to meet the demand.

Shropshire and Stafford.—The supply of labour is generally sufficient, though in some districts there is still a scarcity of skilled men.

Derby, Nottingham, Leicester, and Rutland.—The supply of labour is about sufficient, although in some districts there is a shortage of skilled hands. Casual labour for lifting the roots was plentiful.

Lincoln and Norfolk.—Generally the supply of labour is sufficient, but skilled men are wanted in some districts.

Suffolk, Cambridge, and Huntingdon.—Except in one district of east Suffolk, where there appears to be a shortage of labour of all kinds, and in south Cambridge, where horsemen and cattlemen are in demand, the supply of labour is sufficient, or even plentiful.

Bedford, Northampton, and Warwick.—The supply of the less skilled labour is almost everywhere sufficient; but in most districts more skilled men are required, horsemen, cattlemen, and shepherds being specially mentioned.

Buckingham, Oxford, and Berkshire.—The supply of labour generally is equal to the demand, though here and there deficiencies of both skilled and unskilled men are reported.

Worcester, Hereford, and Gloucester.—The supply of labour is adequate generally, but there are still local shortages of skilled labour.

Cornwall, Devon and Somerset.—Except as regards skilled men, of whom, in most districts, more are required, the supply of labour is fully up to requirements.

Dorset, Wiltshire, and Hampshire.—The supply of labour is greater than is required in some districts, though skilled men are sometimes scarce.

Surrey, Kent, and Sussex.—The supply of labour is sufficient to meet the demand, except for skilled men, which are scarce in some districts.

Essex, Hertford, and Middlesex.—The supply of labour is adequate, though in north and east Essex there is still a shortage of skilled men.

North Wales.—Generally the supply of labour is adequate, but skilled men are still rather scarce in some districts.

Mid Wales.—Except in the south of Breconshire there appears to be sufficient labour available.

South Wales.—The supply of labour continues to improve, but skilled men are often hard to find.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of November, 1917, 1918, and 1919.

	WHEAT.			BARLEY.				OATS.		
	1917	1918	1919.	1917.	1918.	1919		1917.	1918.	1919.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.		s. d.	s. d.	s. d.
London ...	72 1	73 9	73 0	61 6	61 7	108 5		47 7	65 1	60 7
Norwich ...	70 6	72 3	72 8	60 3	60 9	102 9		41 10	57 5	59 6
Peterborough ...	69 8	72 2	72 7	60 0	60 7	102 7		41 0	47 7	57 2
Lincoln ...	70 4	72 4	72 11	60 3	61 4	104 0		42 4	61 8	59 6
Doncaster ...	70 0	71 11	72 7	58 9	59 10	100 10		41 0	53 7	60 9
Salisbury ...	69 9	72 1	72 4	60 3	60 8	88 0		41 7	53 4	54 6

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1917, 1918 and 1919.

Weeks ended (in 1919).	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919.	1917.	1918.	1919.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Jan. 4 ...	76 0	71 2	72 2	66 4	58 0	62 3	47 1	45 5	48 8
" 11 ...	75 8	71 2	72 6	65 7	58 2	62 5	47 2	46 9	49 8
" 18 ...	75 8	71 3	72 7	64 9	58 1	62 3	47 4	47 9	50 0
" 25 ...	75 10	71 1	72 7	64 5	58 7	61 10	47 8	48 2	49 6
Feb. 1 ...	75 10	71 2	72 8	64 0	58 10	62 4	47 3	50 2	49 7
" 8 ...	76 0	72 0	72 7	63 5	59 0	62 3	46 11	50 6	49 2
" 15 ...	76 3	72 3	72 8	63 8	58 11	62 5	47 3	52 0	49 0
" 22 ...	76 9	72 2	72 8	63 9	58 9	62 6	47 8	52 3	49 4
Mar. 1 ...	77 4	72 2	72 7	64 0	57 9	62 7	48 0	52 0	48 8
" 8 ...	78 0	72 3	72 6	63 7	58 5	62 7	48 7	52 2	48 6
" 15 ...	78 10	72 4	72 5	64 1	59 10	62 5	49 4	51 0	46 8
" 22 ...	80 3	72 3	72 7	65 6	56 9	62 1	50 4	50 3	46 4
" 29 ...	81 5	72 4	72 7	71 10	56 7	62 8	51 10	48 10	46 11
Apr. 5 ...	84 4	72 11	72 6	69 11	56 7	62 8	55 1	49 10	47 2
" 12 ...	85 2	73 3	73 0	71 10	56 6	62 9	57 2	47 4	47 1
" 19 ...	84 10	73 3	73 1	70 6	56 6	62 9	59 8	47 0	47 3
" 26 ...	81 1	73 3	73 1	69 5	56 10	62 9	58 6	46 8	48 1
May 3 ...	77 7	73 5	73 2	64 4	56 5	62 8	54 9	47 4	48 7
" 10 ...	78 0	73 5	73 2	64 11	56 0	63 1	55 2	47 6	47 5
" 17 ...	77 11	73 4	73 3	64 10	56 0	62 4	55 2	46 4	47 11
" 24 ...	78 0	73 3	73 2	64 9	56 6	62 7	54 11	47 8	47 11
" 31 ...	78 0	73 8	73 3	65 11	60 0	62 7	54 11	44 9	48 3
June 7 ...	78 0	73 11	73 2	67 7	59 2	62 6	55 0	45 5	47 10
" 14 ...	78 2	74 3	73 3	75 6	57 9	62 8	55 1	45 7	48 11
" 21 ...	78 1	74 4	73 3	75 0	58 5	62 8	55 2	47 8	48 7
" 28 ...	78 3	74 4	73 3	73 11	57 10	63 4	55 1	46 4	49 1
July 5 ...	78 1	74 4	73 4	69 5	61 7	62 4	55 2	46 10	49 0
" 12 ...	78 2	74 4	73 3	70 10	57 5	63 1	55 1	47 0	49 11
" 19 ...	78 3	74 3	73 4	72 1	60 5	62 9	55 2	45 4	49 11
" 26 ...	78 3	74 3	73 4	65 7	56 11	63 4	55 2	46 2	48 11
Aug. 2 ...	78 2	74 3	73 3	73 6	57 1	62 10	55 0	45 10	50 3
" 9 ...	78 4	74 7	73 4	76 1	57 7	73 8	55 0	46 3	55 6
" 16 ...	78 7	74 2	73 3	68 11	61 4	75 2	55 6	55 11	61 4
" 23 ...	76 7	74 8	73 10	70 7	62 6	83 4	54 7	50 9	62 0
" 30 ...	72 1	74 8	73 3	60 4	60 1	86 7	49 0	57 11	61 10
Sept. 6 ...	71 0	72 3	73 4	59 3	60 4	89 3	46 7	56 9	61 1
" 13 ...	70 7	72 5	73 5	57 2	60 1	92 5	45 0	49 2	62 4
" 20 ...	70 8	72 6	73 4	56 10	60 4	94 7	45 8	49 11	61 3
" 27 ...	70 6	72 7	73 0	58 5	60 3	95 2	44 7	50 3	60 2
Oct. 4 ...	70 8	72 8	73 4	57 9	60 3	94 4	44 9	50 9	59 6
" 11 ...	71 0	72 6	73 1	58 5	60 3	95 5	44 5	51 6	58 10
" 18 ...	70 8	72 7	73 0	59 3	60 3	93 10	44 1	50 9	57 9
" 25 ...	70 10	72 5	73 0	60 1	60 3	95 1	43 0	50 5	57 5
Nov. 1 ...	70 4	72 4	72 9	59 11	60 3	96 0	42 4	50 8	56 4
" 8 ...	70 3	72 4	72 8	60 2	60 3	97 10	42 11	49 11	55 3
" 15 ...	70 3	72 5	72 7	60 2	60 3	100 7	43 0	49 10	55 7
" 22 ...	70 2	72 4	72 7	59 9	60 10	104 11	43 1	51 1	55 11
" 29 ...	70 2	72 3	72 7	59 3	62 2	107 9	44 6	50 4	56 0
Dec. 6 ...	70 7	72 4	72 7	58 7	62 6	108 11	43 5	51 4	55 10
" 13 ...	71 2	72 3	72 6	58 0	62 7	105 2	43 6	51 4	56 9
" 20 ...	71 1	72 4		57 7	62 3		44 2	50 5	
" 27 ...	71 1	72 3		57 7	62 3		44 10	50 6	

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in November and October, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	NOVEMBER.		OCTOBER.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
FAT STOCK :—	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	79 6	74 4	79 1	74 2
Herefords	79 3	74 3	78 7	73 7
Shorthorns	79 1	74 2	78 8	73 10
Devons	79 0	74 1	78 8	73 8
Welsh Runts... ..	78 8	74 10	78 6	74 0
Fat Cows	74 1	66 4	73 9	65 9
	First Quality. per lb.*	Second Quality. per lb.*	First Quality. per lb.*	Second Quality. per lb.*
	d.	d.	d.	d.
Veal Calves	16	14	14½	12½
Sheep :—				
Downs	14½	14½	14½	14½
Longwools	14½	14½	14½	14½
Cheviots	14½	14½	14½	14½
Blackfaced	14½	14½	14½	14½
Welsh... ..	14½	14½	14½	14½
Cross-breds	14½	14½	14½	14½
	per score. live weight.	per score. live weight.	per score. live weight.	per score. live weight.
	s. d.	s. d.	s. d.	s. d.
Pigs :—				
Bacon Pigs	21 0	21 0	21 0	21 0
Porkers	21 0	21 0	21 0	21 0
LEAN STOCK :—	per head	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	56 16	42 18	54 1	40 17
„ — Calvers ...	52 12	39 0	48 8	37 15
Other Breeds—In Milk ...	46 10	34 19	46 2	35 2
„ — Calvers ...	—	—	33 0	28 0
Calves for Rearing	3 17	2 17	3 12	2 13
Store Cattle :—				
Shorthorns—Yearlings ...	15 3	12 2	14 19	12 6
„ —Two-year-olds ...	27 1	21 11	26 10	21 11
„ —Three-year-olds ...	37 7	32 3	36 19	31 10
Herefords—Two-year-olds ...	28 19	24 15	27 16	23 14
Devons— „	27 18	23 9	27 6	22 14
Welsh Runts— „	27 7	20 13	27 0	—
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	63 3	50 9	63 3	51 3
Store Pigs :—				
8 to 12 weeks old	44 8	32 3	49 4	36 6
12 to 16 „ „	90 9	70 11	89 3	71 2

* Estimated carcass weight.

NOTE.—The prices per lb. for sheep do not include the value of the skins, which during November made prices equivalent to an additional 2½d. per lb. of the carcass weight for Downs and Welsh, and 2½d. for Longwools, Cheviots, Blackfaced and Crossbreds, and during October, 2d. per lb. for Downs, Blackfaced, Welsh and Crossbreds, and 2½d. for Longwools and Cheviots.

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at
certain MARKETS in ENGLAND in November, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER :—	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
British	per 12 lb. —	per 12 lb. —	per 12 lb. —	per 12 lb. —	per 12 lb. 27 6	per 12 lb. —
Irish Creamery—Fresh	per cwt. —	per cwt. —	per cwt. —	per cwt. —	per cwt. —	per cwt. —
„ Factory	—	—	—	—	—	—
Imported (Controlled)	252 0	—	252 0	—	252 0	—
CHEESE—						
British—						
Cheddar	144 6	—	120 lb. —	—	144 6	—
Cheshire	—	—	155 0	—	155 0	—
Canadian	144 6	—	per cwt. 144 6	—	per cwt. 144 6	—
BACON :—						
Irish (Green)	195 6	—	195 6	—	195 6	—
Canadian (Green sides)	192 0	—	192 0	—	192 0	—
HAMS :—						
York (Dried or Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green) (long cut)	195 0	—	195 0	—	195 0	—
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British... ..	—	—	—	—	50 0	—
Irish	49 6	—	49 0	47 3	49 3	46 6
American	30 0	33 0	33 3	32 0	33 3	30 6
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Arran Chief	220 0	180 0	203 6	190 0	242 6	225 0
Edward VII.	245 0	221 0	245 0	235 0	256 0	238 6
Other Late Varieties...	215 0	195 0	185 0	155 0	240 0	220 0
HAY :—						
Clover	—	—	310 0	—	300 0	280 0
Meadow	—	—	—	—	295 0	275 0

**AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in November, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	Quality.	Birming- ham.	Leeds.	Le don.	Man- chester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—					
English	1st	140 0	140 0	140 0	140 0
	2nd	140 0	140 0	140 0	140 0
Cow and Bull	1st	140 0	140 0	140 0	140 0
	2nd	140 0	140 0	121 6	121 6
Irish: Port Killed	1st	140 0	—	140 0	—
	2nd	140 0	—	140 0	—
Argentine Frozen—					
Hind Quarters	1st	126 0	126 0	126 0	126 0
Fore „	1st	98 0	98 0	98 0	98 0
Australian Frozen—					
Hind Quarters	1st	126 0	—	126 0	125 0
Fore „	1st	98 0	—	98 0	98 0
New Zealand Frozen—					
Hind Quarters	1st	—	—	126 0	—
Fore „	1st	—	—	98 0	—
VEAL :—					
British	1st	98 0	98 0	98 0	98 0
	2nd	—	92 0	87 6	98 0
MUTTON :—					
Scotch	1st	147 0	147 0	147 0	147 0
	2nd	147 0	147 0	147 0	147 0
English	1st	147 0	147 0	147 0	147 0
	2nd	147 0	147 0	147 0	147 0
Irish: Port Killed	1st	—	—	—	—
	2nd	—	—	—	—
Argentine Frozen	1st	106 0	106 0	106 0	101 6
New Zealand „	1st	—	—	106 0	—
Australian „	1st	—	—	106 0	98 0
LAMB :—					
British	1st	147 0	147 0	147 0	147 0
	2nd	147 0	147 0	147 0	147 0
New Zealand	1st	106 0	—	106 0	—
Australian	1st	—	—	106 0	108 6
Argentine	1st	106 0	106 0	106 0	—
PORK :—					
British	1st	—	—	149 6	149 6
	2nd	—	—	—	—
Frozen	1st	—	—	133 0	—

DISEASES OF ANIMALS ACTS 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	36	19	212	221
Animals attacked	47	23	280	2,8
Foot-and-Mouth Disease :—				
Outbreaks	21	—	70	3
Animals slaughtered as diseased or exposed to infection ...	1,304	—	3,066	40
Glanders (including Farcy) :—				
Outbreaks	1	3	22	31
Animals attacked	4	15	58	92
Parasitic Mange :—				
Outbreaks	270	311	4,593	4,011
Animals attacked	463	519	9,132	7,455
Rabies :—				
Number of cases	2	39	143	86
„ „ Dogs affected	2	38	148	83
„ „ other animals affected	—	1	5	3
Sheep scab :—				
Outbreaks	55	39	321	304
Swine Fever :—				
Outbreaks	242	120	2,159	1,300
Swine slaughtered as diseased or exposed to infection ...	106	63	995	526

IRELAND.

(From the Returns of the Department of Agriculture and Technical
Instruction for Ireland.)

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	—	—	—	2
Animals attacked	—	—	—	2
Glanders (including Farcy) :—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Parasitic Mange :—				
Outbreaks	5	3	135	95
Sheep scab :—				
Outbreaks	37	40	257	296
Swine Fever :—				
Outbreaks	1	4	31	28
Swine slaughtered as diseased or exposed to infection ...	3	53	96	129

The Weather in England during November.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours
<i>Week ending 8th Nov.:</i>								
England, N.E. ...	39.7	-5.0	0.04	24	+10	6	0.7	-1.3
England, E. ...	39.5	-5.7	0.61	15	+2	5	0.2	-2.3
Midland Counties ...	38.1	-6.3	0.33	8	-9	5	0.4	-1.5
England, S.E. ...	39.5	-6.6	0.31	8	-13	5	0.1	-2.3
England, N.W. ...	39.5	-6.1	0.16	4	-19	3	0.5	-1.3
England, S.W. ...	39.8	-7.3	0.27	7	-21	4	1.3	-1.0
English Channel ...	45.0	-5.9	1.18	30	+2	6	1.2	-1.4
<i>Week ending 15th Nov.:</i>								
England, N.E. ...	33.2	-9.3	0.68	17	+3	6	1.3	-0.6
England, E. ...	34.9	-8.3	0.37	9	-6	5	2.1	-0.1
Midland Counties ...	32.7	-9.3	0.17	4	-10	4	1.3	-0.7
England, S.E. ...	34.8	-9.5	0.50	13	-4	4	2.0	-0.4
England, N.W. ...	33.3	-10.0	0.21	5	-15	3	2.7	+0.8
England, S.W. ...	34.2	-10.0	0.34	9	-13	3	2.7	+0.3
English Channel ...	41.2	-7.7	0.81	31	+9	5	3.0	+0.3
<i>Week ending 22nd Nov.:</i>								
England, N.E. ...	38.8	-2.7	0.33	8	-3	5	3.1	+1.3
England, E. ...	40.0	-1.6	0.45	11	0	4	2.8	+1.1
Midland Counties ...	40.6	-0.5	0.58	15	+4	6	2.1	+0.6
England, S.E. ...	42.0	-0.9	0.51	13	-1	6	2.5	+0.8
England, N.W. ...	41.3	-1.0	1.20	31	+11	6	1.5	-0.1
England, S.W. ...	44.6	+0.5	1.33	34	+13	6	1.6	-0.3
English Channel ...	48.3	+1.8	1.00	26	+7	7	1.7	-0.3
<i>Week ending 29th Nov.:</i>								
England, N.E. ...	39.1	-2.3	0.76	19	+4	6	1.2	-0.2
England, E. ...	38.8	-2.5	0.39	10	-5	3	2.0	+0.5
Midland Counties ...	39.1	-1.8	0.38	10	-7	4	1.4	+0.0
England, S.E. ...	40.8	-2.1	0.88	22	+4	5	2.3	+0.7
England, N.W. ...	40.3	-2.1	0.52	13	-11	5	1.2	-0.1
England, S.W. ...	41.0	-2.8	0.74	19	-7	5	2.5	+0.9
English Channel ...	48.3	-2.1	1.36	35	+10	6	2.7	+0.9

* 1 inch = 25.4 millimetres.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

- Kenyon, A. M., and Lovitt, W. V.*—Mathematics for Agriculture and General Science. (333 pp.) New York and London: The Macmillan Company, 1918. [51.]
- Chapman, E. H.*—The Study of the Weather. (131 pp.) London: Cambridge University Press, 1919. 3s. 6d. net. [551.5.]
- Lloyd, S. L.*—Mining and Manufacture of Fertilising Materials and their Relation to Soils. (153 pp.) New York: D. van Nostrand Co.; London: Crosby Lockwood & Son, 1919. [63.16(02); 63.1621.] 9s. net.
- Mercier, C.*—A Manual of the Electro-Chemical Treatment of Seeds. (134 pp.) London: University of London Press, 1919. 3s. 6d. net. [63.1951; 537.]
- Magnus, H.*—Theorie und Praxis der Strohaufschliessung. (43 pp.) Berlin: Paul Parey, 1919. 63.004(a).]
- Wenckstern, Dr. H. v.*—Das neue Susspressfuttermittelverfahren in Silos mit Selbsttätiger Pressvorrichtung. (101 pp.) Berlin: Paul Parey, 1919. [63.1985.]
- Punnett, R. C.*—Mendelism. 5th edition. (215 pp.) London: Macmillan Company, 1919. 7s. 6d. net. [575.1.]
- British Columbia, Legislative Assembly.*—Bull. 8. :—Agriculture of British Columbia. (28 pp.) Victoria, B.C., 1919. [63(71).]
- Neville, H. A. D., and Newman, L. F.*—A Course of Practical Chemistry for Agricultural Students. Vol. II, Part I. (122 pp.) Cambridge: University Press, 1919. 5s. net. [54(02).]
- Clarke, J. (Edit.).*—Problems of National Education, by Twelve Scottish Educationalists. (368 pp.) London: Macmillan Company, 1919. 12s. net. [37(02).]
- Cook, M. T.*—Applied Economic Botany based upon Actual Agricultural and Gardening Projects. (261 pp.) Philadelphia and London: J. B. Lippincott Company, 1919. 7s. 6d. net. [58(02); 575.4.]
- Few, M.*—My Five-acre Holding. (164 pp.) London: Hodder & Stoughton, 1919. 3s. 6d. net. [63.5(02); 63.191.]

Field Crops—

- Jenkin, T. J.*—Pasture Studies.—Some Results. (58 pp.) Bangor: Jarvis & Foster, 1919. [63.33(02).]
- Harris, F. S.*—The Sugar Beet in America. (342 pp.) New York and London: The Macmillan Company, 1919. 10s. net. [Contains Bibliography, 17 pages.] [63.3432.]

Horticulture—

- Garnett, D.*—The Kitchen Garden and its Management. (90 pp.) London: Selwyn & Blount, 1919. 1s. net. [63.51(04).]
- Smith, T.*—The Profitable Culture of Vegetables. (New impression.) (452 pp.) London: Longmans, Green & Co., 1919. 7s. 6d. net. [63.51(02).]
- Bedford, Duke of, and Pickering, S.*—Science and Fruit Growing: Being an Account of the Results obtained at the Woburn Experimental Fruit Farm since its Foundation in 1894. (348 pp.) London: Macmillan & Co., 1919. 12s. 6d. net. [63.41(02).]

Plant Diseases—

- Eriksson, J.*—Die Schwedischen Gymnosporangien: Ihr Wirtswechsel und Ihre Spezialisierung. (82 pp.+4 pl.) [Kungl. Svenska Vetenskapsakademiens Handlingar. Band 59. No. 6.] Stockholm, (London: W. Wesley), 1918. [63.24.]
- Eriksson, J.*—Zwei russische Gymnosporangien: Eine biologisch-systematische Studie. (23 pp.+3 pl.) [Archiv. für Botanik, Band 15. No 20.] Stockholm, 1919. [63.24.]
- Pethybridge, G. H., and Lafferty, H. A.*—A Disease of Tomato and other Plants caused by a New Species of Phytophthora (487–505 pp. + 3 pl.) [Sci. Proc. Roy. Dub. Soc., Vol. xv. (N.S.), No. 35, February, 1919.] London: Williams & Norgate, 1919. 1s. 6d. [63.24.]

- Weir, J. R.*—Notes on the Altitudinal Range of Forest Fungi. (14 pp.) [Reprinted from *Mycologia*, Vol. X., No. 1, 1918.] [63.24-49.]
- Yeld, Ellen.*—Practical Cheesemaking. (Fifth Edition). (55 pp.) Leominster, 1919. 2s. net. [63.7(02).]
- Royal Society.*—Reports of the Grain Pests (War) Committee. No. 5. (10 pp.) London: Harrison & Sons, 1919. 1s. [63.27-31.]
- Duncan, F. M.*—Insect Pests and Plant Diseases in the Vegetable and Fruit Garden. (95 pp.) London: Constable & Co., 1919. 3s. 6d. net. [63.2(02).]

Live Stock—

- Mackenzie, K. J. J.*—Cattle and the Future of Beef-production in England. (168 pp.) Cambridge: University Press, 1919. 7s. 6d. net. [63.603; 63.62(02).]
- Bird, J. T.*—Practical Cavy-Keeping, with a Chapter on the Profitable Breeding of Fancy Mice. (32 pp.) London: "Country Life," 1919. 9d. net. [63.69.]

Veterinary Science—

- Shipley, A. E.*—More Minor Horrors. (163 pp.) London: Smith, Elder & Co., 1916. 1s. 6d. net. [Contains chapters on the Warble Fly, Rats, and the Field-Mouse.] [59.169; 619.2(f); 63.269.]

Birds, Poultry and Bees—

- Toovey, T. W.*—Commercial Poultry Farming. (140 pp.) London: Crosby, Lockwood & Son, 1919. 7s. 6d. net. [63.65(02).]
- International Association of Poultry Instructors.*—Official Report of the International Poultry Conference, 11th to 15th March, 1919. London, 31, Essex Street, Strand, W.C. 4s. net. [63.6(06); 63.65(02).]

Engineering—

- Bocher, Henri.*—La Motoculture en 1919. (48 pp.) Paris: La Ligue pour le Retour à la Terre, 1919. Fr. 2. [63.175.]
- Grunert, Dr. A.*—Anleitung zur Drainage. (66 pp.) Berlin: Paul Parey, 1919. M.2 + 20%. [63.14(04).]
- Weaver, L.*—The "Country Life" Book of Cottages," 2nd edition. (266 pp.) London: "Country Life," 1919. 9s. 6d. net. [69(02).]
- Nyrop, C.*—Det Danske Hedeselskab, 1866-1916. (230 pp.) Kobenhavn, 1916. [63.142.]
- Williams-Ellis, C.*—Cottage Building in Cob, Pisé, Chalk and Clay. (125 pp.) London: "Country Life," 1919. 6s. net. [69(02).]
- Ronse, A., et Raison, T.*—Fermes-Types et Constructions Rurales en West-Flandre. Tome 1. (269 pp.) Tome 11. (306 pp.) Bruges: Charles Beyaert, 1918. 75 francs the two volumes. [69(02).]
- Danish Heath Society.*—A concise Report of the Proceedings of the Society and a Programme of the Heath Excursion, 21st August, 1919. (8 pp.) Viborg, 1919. [63.142.]

Economics—

- Cymmrodorion Society's Publications.*—Some Problems of Rural Reconstruction in Wales. London: Published by the Society, 1919. [338.98.]

THE JOURNAL

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EDITORIAL NOTES.

As far as the past year is concerned agriculturists may be pardoned if they speak of it as *annus mirabilis*, though perhaps all its fruits are in a way the ripening harvest of the Corn Production Act. In introducing that measure the Prime Minister announced the coming of the changes for which the year 1919 has paved the way. After something like forty years in the wilderness of national indifference and neglect, agriculture received special consideration, and the Government has undertaken to provide legislation for its most pressing needs. Now we are able to see the national policy taking shape. Five Acts of Parliament affecting agricultural interests have been successfully carried through. They are the Land Settlement (Facilities) Act, the Forestry Act, the Agricultural Sales (Restriction of Notices to Quit) Act, the Rats and Mice (Destruction) Act, and the Ministry of Agriculture and Fisheries Act. Regarded as parts of a comprehensive national programme it will be seen that all these measures serve in their own fashion to strengthen the position of agriculture in England. They provide the necessary machinery for developments that are regarded as necessary in the best interests not only of agricultural but of industrial England, which must, perforce, depend to a large extent upon the prosperity of British farming. When we come to consider the normal pace of legislative progress it is clear that we have seen in 1919 developments to which no preceding year within the limits of living memory can afford a parallel. At the same time it is well to remember that the legislative programme is by no means exhausted by what has gone before. Indeed, the Acts to which Parliament has already given approval are, in a way, the prelude to still wider measures. The Interim Report of the Royal Commission (see pp. 964 and 967) provides a

basis for legislation that will guarantee a minimum return for the farmers' cereal crops. The Milk and Dairies Act passed in 1915 will come into operation within twelve months after the formal termination of the War. A Seeds and Weeds Bill is now before the House of Commons and will, it is hoped, become law by harvest time. Finally, as stated in the following note, the old Board of Agriculture have succeeded to the status of a First Class Department and will be known in future as the Ministry of Agriculture, with wider powers and larger provisions for their exercise. Whatever the difficulties before agriculturists to-day—and nobody would endeavour to minimise them—it is clear that the year behind us has accomplished much towards the clearing of the outlook and that the year before us promises to do still more.

THE Ministry of Agriculture and Fisheries Bill, which was originally called the "Agriculture (Councils) Bill," has passed

**The Ministry of
Agriculture
and Fisheries
Act.**

into law. In brief, the Act substitutes a Minister of Agriculture and Fisheries for the Board of Agriculture and Fisheries, sets up Councils of Agriculture for England and Wales and an Agricultural Advisory Committee for both countries, defines their powers, duties and constitution, and amends the Board of Agriculture and Fisheries Acts from 1889-1909. The Act also establishes Agricultural Committees on which executive powers can be conferred in the counties of England and Wales, to which Committees the duties of the County Councils appertaining to agriculture will stand referred. These important new bodies have been designed to give expression to the agricultural interests of the two countries; they afford a complete answer to any suggestion that the Act will tend to create a central bureaucracy in London. The County Committees will be appointed partly by the County Councils and partly by the Ministry; the Advisory Councils will be representative of the County Committees and in part nominated by the Ministry. To outward seeming the Act is one of purely local and personal significance, but, seen with a larger vision, it becomes part of the great agricultural development that the Government propose to bring about. The old Board had less than sufficient status for the work they are asked to undertake, which is nothing less than the care of what the Prime Minister has called "our greatest national industry."

Now that the paramount claims of agriculture have been realised by all who have eyes to see and intelligence to understand, the handling of agricultural questions must be carried out in a fashion befitting their importance to the nation. On this account it has been found necessary to raise the status of the old Board and to extend their Powers until they are adequate to the needs of the Country and the times we live in.

* * * * *

THE passing of the Forestry Act, which came into force on 1st September last, has created comparatively little attention,

**The Forestry Act,
1919.**

but the Act itself is of far-reaching importance. Eight Forestry Commissioners (five of them unpaid) are appointed to serve for five years and are eligible for reappointment (see p. 1039). They are charged with the general duty of promoting the interests of forestry, the development of afforestation and the production and supply of timber in the United Kingdom. They have taken over the powers and duties of the Ministry of Agriculture and Fisheries, the Board of Agriculture for Scotland and the Department of Agriculture and Technical Instruction for Ireland in so far as these relate to forestry and in so far as the Destructive Insects and Pests Acts of 1877 and 1907 relate to forest trees and timber. One of the unpaid Commissioners will be a member of the Commons House of Parliament (Mr. L. Forestier-Walker, M.P., has received the appointment under this Clause). The position of the Commissioner appointed will be similar to that of the Charity Commissioner in the House. He will answer all questions relating to forestry. The Commissioners, subject to Treasury direction, may purchase or take on lease and hold any land suitable for a Forest Station, and may plant and manage it. They may sell or let or exchange any land which has proved unnecessary or unsuitable for their purpose, but before acquiring, selling, or otherwise disposing of land the Commissioners shall consult the appropriate Agricultural Department, and if selling or disposing of land shall give that Department an opportunity of acquiring the same. (The appropriate Agricultural Department in England and Wales is the Ministry of Agriculture and Fisheries, in Scotland the Board of Agriculture for Scotland, and in Ireland the Department of Agriculture and Technical Instruction for Ireland).

The Commissioners may acquire standing timber and lands for the purpose of a Forest Station. They may undertake the management or supervision of woods and forests; establish or carry on or aid woodland industry; undertake statistical

and educational work relating to forestry ; conduct inquiries, experiments and research ; and take such steps as they think necessary for the purpose of securing an adequate supply of timber in the United Kingdom and of promoting the production of timber in His Majesty's Dominions. Other powers the Commissioners hold are for the prevention of damage by rabbits and vermin ; the appointment of Assistant Commissioners, and the compulsory acquisition of land. A Forestry Fund is established out of moneys, amounting to £3,500,000, to be provided by Parliament, and to be expended during the first ten years. Any sums received by the Commissioners from the sale of timber or any transactions carried out by them in the exercise of their powers and duties will be credited to that Fund. Commissioners will present an Annual Report of their proceedings to both Houses of Parliament.

* * * * *

THE Commissioners were unable to present their Interim Report by 30th September as requested, but they reported on the 10th of December last, limiting their

**Interim Report of
the Royal
Commission on
Agriculture.**

views to the question of whether the guarantees given to farmers under Part I. of the Corn Production Act, 1917, should be continued or not, and if continued, whether any alteration is required either in their amount or in the conditions attached to them. The Report (see also p. 967), though brief, contains an interesting review of agricultural conditions since 1870, and some account of the Committees set up by Lord Selborne, then President of the Board of Agriculture, in June, 1915, and July, 1915, together with the Report of the Committee appointed by the Prime Minister under the chairmanship of Lord Selborne in August, 1916. It may be remembered that the Committee of July, 1915, expressed the opinion that as a result of the War the nation might decide that "national security demands a substantial increase in the agricultural output of this country." The Committee over which Lord Selborne presided recommended in January, 1917 (1) that certain minimum prices for wheat and oats should be guaranteed ; (2) that a minimum wage for agricultural labour should be established and an Agricultural Wages Board set up ; and (3) that the Board of Agriculture should be empowered to supersede owners temporarily or even dispossess occupiers of land which was being badly managed or cultivated. Upon this last Report the Corn Production Act of 1917 was based.

The Interim Report of the Royal Commission makes the following recommendations :—

- (1) That, subject to the conditions set out in the following paragraphs, minimum prices for wheat, barley, and oats grown in Great Britain be guaranteed by the State, on the same principle and conditions as are laid down in Part I. of the Corn Production Act, 1917, the producer being allowed an unrestricted market for his produce, but the State retaining the right to control prices in case of national emergency.
- (2) That barley should be dealt with in the same manner as wheat under Section 1 of the Corn Production Act, payment of four times the difference between the average price as defined in the Act and the guaranteed minimum price per quarter being made in respect of that cereal.
- (3) That for the grain crops of 1920 and subsequent years the guarantees be calculated from year to year on a sliding scale based on the average bare costs of cereal production of the preceding year, rent being disregarded for this purpose ; and that the datum line to which increases or decreases in the average costs of the 1920 grain crops above or below those of 1919 should be applied, shall be 68s. per quarter of 504 lb. of wheat, 59s. per quarter of 448 lb. of barley, and 46s. per quarter of 336 lb. of oats.
- (4) That the guarantees be continued until Parliament otherwise decides, subject to not less than four years' notice of withdrawal being given.
- (5) That, if found necessary, the powers under Part IV. of the Corn Production Act be extended so as to enable the Boards of Agriculture or the County Committees to take effective action against any landowner or farmer who impedes or neglects to carry out the Orders issued by them for the better cultivation of the holding.
- (6) That any payment in respect of the guaranteed prices be dependent upon the production of a certificate from the Department concerned to the effect :—
 - (a) That the holding in respect of which payment under the guarantees is claimed has been well cultivated and an adequate amount of labour employed upon it, or that such labour was not available ; and

- (b) That either one-eighth part of the holding or one-fourth part of the arable land (whichever be the greater) is under cereal crop, or that so much less of the holding is under cereal crop as appears to be desirable in the public interest.

The Minority Interim Report is almost as long as the Majority Report, with which the Minority signatories find themselves unable to agree. They express the opinion that the present high cost of imported grain and the rates of exchange now operating against this country act as a substantial protective duty on the produce of British agriculture, and they point out that several competent judges consider that the unexhausted fertility in grass land was a valuable asset in the late time of war. They are not convinced that measures found necessary during war should be continued in time of peace. They do not find it possible to recommend the guarantee of prices that may render remunerative such wheat areas as are only able to produce $3\frac{1}{2}$ qr. or less to the acre. Arguments are adduced against the policy of guarantees and, finally, the Commissioners signing the Minority Report make the following three recommendations :—

- (1) That farmers be informed that they shall be left free to cultivate their land in such manner as they deem best, in accordance with the rules of good husbandry.
- (2) That the Boards of Agriculture organise an efficient system of distribution of all available information relating to the progress and prospects of agriculture, with special reference to the course of world prices.
- (3) That, so long as prices of cereals are controlled by the Government, the farmers be paid at prices not less than those at which the commodities controlled can be imported.

INTERIM REPORT OF THE ROYAL COMMISSION ON AGRICULTURE.

THE Royal Commission, which was appointed on 15th July last to inquire into the economic prospects of the agricultural industry in Great Britain with special reference to the adjustment of a balance between the prices of agricultural commodities, the cost of production, the remuneration of labour, and hours of employment, issued their Interim Report,* dated 10th December, on the 19th December. The Report shows that the Commission, which consist of 23 members, was sharply divided on the main principle with which it deals, namely, the advisability of continuing indefinitely the guarantees of minimum prices for corn on the terms and conditions laid down in the Corn Production Act, 1917. Twelve of the Commissioners were in favour of a scheme of guarantees, whilst eleven were against it. The twelve were the Chairman (Sir William Peat), Sir Wm. Ashley, Dr. C. Douglas, and Messrs. G. G. Rea, Anker Simmons, H. Overman, A. Batchelor, H. S. Cautley, K.C., M.P., E. W. Langford, G. Nicholls, E. H. Parker, and R. R. Robbins. The minority were Messrs. A. W. Ashby, G. Dallas, J. F. Duncan, Wm. Edwards, F. E. Green, J. M. Henderson, T. Henderson, T. Prosser Jones, R. V. Lennard, W. R. Smith, M.P., and R. B. Walker. Mr. H. S. Cautley, one of the signatories of the Majority Report, was in favour of the principle of guarantees, but disagreed with the scheme recommended by his colleagues for its application, and added a separate memorandum giving his reasons for such disagreement.

The main recommendation of the Report is, then, that guaranteed minimum prices should be fixed annually in respect of wheat, barley, and oats grown in Great Britain, on the same principle and conditions as are laid down in Part I. of the Corn Production Act, 1917, the producer being allowed an unrestricted market for his produce, but the State retaining the right to control prices in case of national emergency.

The basis recommended for the annual fixing of the prices is the average bare cost of cereal production in each year ending Michaelmas compared with the average bare cost in the previous year, both sets of costs to be ascertained by the Agricultural Costings Committee. The datum line to which increases or decreases in the average cost of the 1920 crop of each cereal

* Cd. 473, price 3d.

above or below those of 1919 are to be applied is recommended at 68s. per quarter of 504 lb. of wheat, 59s. per quarter of 448 lb. of barley, and 46s. per quarter of 336 lb. of oats.

The datum line figures were estimated by the Commission after considering a large body of evidence as to actual costs of cereal production in 1917-18, and raising the average bare costs for that year by the percentage of increase in costs which the evidence before them indicated had taken place between 1917-18 and 1918-19. The scheme of guarantees recommended is one which is calculated to return to the farmer in those years when world prices fall below the average costs of production an amount nearly up to his out-of-pocket expenditure in producing the crop. In other words, the guarantees are guarantees against serious loss, and are designed to add to the farmer's feeling of security so that he may be placed in a good position to undertake the breaking up of more pasture where to do so would seem a sound business proposition, or, if he has no fresh land to break up, so that he will be able to see his way to retain under the plough all the newly-broken up land which produces a fair crop.

The object of the proposed guarantees is precisely the same as that of the Corn Production Act, 1917, namely, to encourage the growth of cereals and arable cultivation. As the Report states, this object was considered and reported upon by various Committees during the War, nearly all of which were decidedly in favour of its attainment by a system of guarantees. Lord Milner's Committee, which reported in 1915,* stated that to obtain any substantial increase in the production of wheat, oats, and potatoes, it would be necessary for farmers to sacrifice the comparative certainty of their profits at that time, to change some of their methods, to alter their rotations, and to increase their area of arable cultivation, in the face of the shortage of labour then existing. It was recognised that, if they did this, they would have to run the risk not only of uncertain seasons but also of a fall in the price of wheat at the conclusion of the War, and the Committee expressed the opinion that it was essential in order to ensure a general movement in the direction of increased wheat production that a minimum price for home-grown wheat should be guaranteed for a period of several years. The Selborne Committee,† which was a sub-committee of the Reconstruction Committee, made recommendations to

* See this *Journal*, September 1915, p. 585, and November, 1915, p. 803.

† See this *Journal*, April, 1917, p. 1. A review of the Final Report of this Committee was published in the issue of this *Journal*, July, 1918, p. 385.

the same effect, and laid down the principles which were subsequently embodied in the Corn Production Act, 1917. These principles were :—

- (a) that certain minimum prices for wheat and oats should be guaranteed,
- (b) that a minimum wage for agricultural labour should be established and Agricultural Wages Boards be set up, and
- (c) that the Boards of Agriculture should be empowered temporarily to supersede or to dispossess occupiers of land which was being managed or cultivated in such a manner as seriously to affect food production.

The Commission reprint in their Report a number of extracts from the previous Committees' Reports, which reflect the strong views held that an increase of arable land is necessary from the points of view :—

- (a) of the need for ensuring, as far as possible, the safety of the food supplies of the nation in time of War ;
- (b) of the need, consequent upon the exhaustion through the War, of restoring man-power by the expansion of the rural population ;
- (c) of the need to repay the huge war debt by national economy in producing as much food as possible at home, and buying as little as possible from abroad.

The Commission point out that the descending scale of guaranteed prices for wheat and oats adopted in the Corn Production Act, 1917, viz., from 60s. to 45s. in the case of wheat, and from 38s. 6d. to 24s. in the case of oats (both for the small or Imperial quarter of 480 lb. for wheat and 312 lb. for oats) for the period 1917-1922, has proved to be too low to give any real assurance to the farmer at the present time. It may be mentioned, however, that as far as the principle of assurance of prices goes, the Government have on several occasions expressed themselves, through the speeches of the Prime Minister and the President of the Board, as strongly in favour of making the assistance to agriculture by guarantees of minimum cereal prices more adequate and lasting ; and further that the President of the Board in his speech at Shrewsbury on the 16th December stated that it was the intention of the Government to give effect to the recommendations of the Royal Commission in this connection early in the coming Session of Parliament.

In return for the advantages of the guarantees, the Royal Commission propose that the powers of oversight and control of farming operations in Part IV. of the Corn Production Act

should be extended so as to enable the Boards of Agriculture or the County Agricultural Committees to take effective action in the Courts or otherwise against any landowner or farmer who refuses or neglects to carry out the Orders issued by them for the better cultivation of the holding. The Commission state that they consider that both the owner and the occupier of land owe the duty to the State of seeing that the holding is cultivated according to the rules of good husbandry, and that no land capable of cultivation should lie unproductive or should be imperfectly cultivated. They add that they would not recommend that systems of cropping should be ordered and regulated except in time of national emergency, but that the Boards and the County Committees should be empowered to determine the proportion of each holding which should be devoted to arable farming.

They further suggest that the guarantees should not be paid, except on production of a certificate authorised by the Boards to the effect —

(a) that the holding in respect of which payment under the guarantees is claimed has been well cultivated and an adequate amount of labour employed upon it, or that such labour was not available; and

(b) that either one-eighth part of the holding, or one-fourth part of the arable land (whichever be the greater) is under cereal crop, or that so much less of the holding is under cereal crop as appears to be desirable in the public interest.

It will be noticed that, following the principle adopted by the Government in giving guaranteed prices for the present year, a guarantee for barley, as well as for wheat and oats, is recommended. The reason given by the Commission for adding barley is that there is a considerable area of land in Great Britain on which that crop can be grown more economically than any other cereal.

The Commission recommend that the guarantees should continue in operation until Parliament otherwise decides, subject to four years' notice being given of their withdrawal should that at any time be decided upon.

The Commission propose to give consideration to other subjects in connection with which assistance might be given to farmers, before they make a Final Report. These subjects include Education, Research and Demonstration; Drainage; Transport; Organisation; Co-operation; Amendments of the

Agricultural Holdings Acts, the Game Laws, and the basis of Local Rating ; and the need for giving further security to the tenant.

With the Interim Report is printed the Minority Report and Mr. Cautley's memorandum. The Minority Report is of considerable interest on account of the arguments it gives against the policy of guarantees. It favours the view that farmers should be left free, without guarantees, to cultivate their land in the way they deem best, and should obtain for their cereals prices not less than those at which grain is imported. They recommend also that the Boards of Agriculture should organise an efficient system of distribution of all available information relating to the progress and prospects of agriculture, with special reference to the course of world prices. Mr. Cautley's memorandum is also an interesting contribution from another point of view. He expresses himself in favour of continuous and substantial guarantees for wheat and oats, the guarantees to be based on the level of agricultural wages, *i.e.*, rising or falling with wages ; with a minimum of restriction on the farmer's freedom of action.

REPORT ON THE PROPOSED ELECTROLYTIC TREATMENT OF SEEDS (WOLFRYN PROCESS) BEFORE SOWING.

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DURING the past three seasons there has been offered to farmers seed treated by an electrolytic process* (Wolfryn process) which, it is claimed, causes marked increase in yield. The cost of the treatment in the case of wheat seed is about 28s. per qr., which works out at about 7s. to 10s. 6d. per acre,

* The details of the treatment are given as follows in Dr. Mercier's book :—
The grain is placed in a solution of 2½–5 per cent. (that is, 4–8 oz. to the gal.) of household salt, in a rectangular water-tight tank made of wood or cemented brick. Both ends of the tank are completely covered inside with a plate of sheet iron about 1/8th in. thick. To each iron plate a terminal is attached for affixing the wires which conduct the electric current. A tank of the following dimensions is a convenient size in which to treat up to 12 bush. at one time, *viz.*, 6 ft. 6 in. long by 3 ft. broad by 1 ft. 6 in. deep. inside measurements.

assuming the usual rate of seeding of about 2 to 3 bush. per acre. On this basis there is no great risk in adopting the treatment, but, on the other hand, if it does no good the money is lost.

Up to the present agricultural experts have not been particularly enthusiastic about the treatment, because samples of seed tested at colleges and experimental stations have in the main proved no better than untreated seed. Similar results have been obtained by certain farmers who have taken the trouble to weigh up their produce. This failure to obtain positive results is explained by the late Dr. Mercier, a well-known believer in the process, in the following way:—

“This was in the early days of the process, when the proper conditions were only guessed at, and when failures were frequent; and the particular experiments in question were failures. They either showed an actual loss, or no gain, or a gain so small as to be within the normal margin of error. In the light of subsequent experience it is now known that, with seed treated as these samples were treated, no benefit could be expected.” (“Manual of the Electro-chemical Treatment of Seeds,” 1919, p. 85.)

On the other hand, other farmers claim to have obtained satisfactory results, and in certain cases where the weighings were carried out by one of the assistants from the University College, Reading, there were considerable differences between crops grown from treated and from untreated seeds respectively.

The Technical Committee of the Food Production Department, therefore, decided to make such tests as were possible in a limited time to ascertain what measure of success a farmer might hope for if he had his seeds treated before sowing.

The solution is first prepared in the tank in the proportion of about 5 gal. to 1 bush. of grain, sufficient well to cover the grain, which should be occasionally turned over during treatment. Oats need $5\frac{1}{2}$ gal.

After the solution has been made ready in the tank, the grain is placed therein and submitted to an electric current of 8 watts per gal. of solution (400 watts for 50 gal., i.e., 2 amperes at 200 volts, or 4 amperes at 100 volts, and so on.)

When large quantities of grain are required to be treated at one time, several tanks are connected in series, and with increased voltage the same electric current will pass through the whole series.

After the treatment is completed the solution is run off and the grain removed from the tanks, and dried at a temperature of from 90 deg. to 100 deg. F. After the moisture has been driven out of the grain, it still remains in a swollen condition, for which due allowance must be made in drilling, otherwise a smaller quantity will be sown per acre than of the corresponding untreated grain.

In soil deficient in lime a solution of 5 per cent. calcium chloride (8 oz. to the gal.) may be used instead of a solution of household salt.

Classes of Treatment.—Broadly speaking, the various methods of treating crops to increase production may be divided into three classes :—

1. Those which are nearly always successful, such as the application of sulphate of ammonia and nitrate of soda to corn or to grass laid in for hay ; of superphosphate to swedes ; of salt and of nitrate of soda to mangolds, etc.
2. Those which apparently succeed in some cases, but fail in others.
3. Those which fail altogether to give crop increases.

The use of artificial fertilisers belongs to the first category. Methods of field trials have been devised by which an experimenter can say with comparative certainty whether or not a fertiliser or a mixture of fertilisers would yield an increase in crop, given a favourable season. He cannot say this with absolute certainty, but the odds are 25 or 30 to 1 against his being wrong. While, therefore, he may make a mistake in any particular case he will not make many mistakes in advising, say, 100 farmers.

It is comparatively easy in a short test to find whether any given process belongs to the first or second category, but it is more difficult to discover whether it belongs to the second or the third.

Broadly speaking, the results of the recent tests made at the colleges and experimental stations go to show that the electrolytic treatment of seed does not belong to the first category. In the majority of the trials the treatment has had no effect ; in some there have been gains, in others losses. On the whole there has been nothing to indicate with certainty any increase in crop. It does not, however, follow that the process necessarily belongs to category 3—the worthless class ; it may still belong to category 2. A single positive result in 100 failures would put it into this class, but obviously this would require a close examination of all the alleged successes, and, what is equally important, of all the failures, before a definite decision could be given.

Pot Experiments.—Experimental tests with treated seed were made at Rothamsted in 1918 and in 1919 ; the experiments were all made in pots, this being the most convenient method for rapid work.

To avoid misapprehension, it should be clearly understood that the vessels used are not flower pots, and that the process

is not the amateurish effort that is sometimes supposed. Further, there are no forced or unnatural conditions. In pot-culture work the conditions are made as natural as possible, but precautions are taken to obviate risk of loss by plant diseases, pests, or severe seasonal factors such as prolonged drought, excessive rain, frost, etc. It may be said that as a result conditions in pots are rather more favourable than those in the field in the ordinary run of seasons, and resemble the conditions obtaining in the field in a good season. Hence the differences shown in pot experiments are not always realised in the field: there are, for example, cases where a 20 per cent. improvement in the pots showed up as only a 10 per cent. improvement in a corresponding field test, and other cases where a treatment giving 10 per cent. improvement in the pots gave no certain improvement in the field. There are very few cases, however, where a treatment fails in the pot-culture house and then succeeds in the field.

The 1918 experiments were made with oats and barley. Soil from ordinary arable land was used. Half of the pots were left unmanured and half were sown with a mixture of artificial manures. Of the unmanured pots half were sown with treated and half with untreated seed. The results were:—

Effect of Manuring.

Average dry weight per pot of five plants. Two pots in each set.

Crop.			No Manure.	Complete Artificial.	Increase per cent. due to Manuring.
<i>Barley.</i>			<i>grams.</i>	<i>grams.</i>	
Expt. 1.	Grain	.. ..	13'0	16'0	23'1
	Straw	.. ..	19'6	35'6	81'6
" 2.	Grain	.. ..	9'8	16'5	68'4
	Straw	.. ..	17'4	33'6	93'1
<i>Oats.</i>					
Expt. 1.	Grain	.. ..	9'25	13'75	48'6
	Straw	.. ..	20'0	36'2	81'0
" 2.	Grain	.. ..	10'4	15'8	51'9
	Straw	.. ..	16'0	36'2	126'3

There were four separate tests and eight separate quantities measured, and in every case, without exception, the manuring increased the crop. This is in accordance with the statement already made that, when properly done, manuring belongs to the first category of treatment, which nearly always succeeds.

The result is entirely different, however, when the electrified seeds are compared with the untreated.

Effect of Electrolytic Treatment.

Average dry weight per pot of five plants. Two pots in each set.

—	Untreated Seed.	Electrified Seed.	Gain or Loss due to Electrolytic Treatment.
<i>Barley.</i>	<i>grams.</i>	<i>grams.</i>	
Expt. 1. Grain	13'0	9'8	Loss of 24'6 per cent.
Straw	19'6	17'4	" 11'2 "
" 2. Grain	16'0	16'5	Gain of 3'1 "
Straw	35'6	33'6	Loss of 5'6 "
<i>Oats.</i>			
Expt. 1. Grain	9'25	10'4	Gain of 12'4 per cent.
Straw	20'0	16'0	Loss of 20'0 "
" 2. Grain	13'75	15'8	Gain of 14'9 "
Straw	36'2	36'2	None.

In five out of the eight cases there is no increase, in some there is a loss. Of the other three cases the slight gain of 3 per cent. is too small for any certainty as to gain to be reckoned; the other two gains might be real, but they do not in any case represent much.

The experiment was repeated in 1919 with seven different lots of wheat, part in each case being treated and part untreated. The seed was received on 20th December, 1918, and sown on 26th February, 1919. The results are set out in the order of merit, and are as follows:—

Treatment apparently advantageous.

Average dry weight per pot of five plants. Three pots in each set.

—	Untreated Seed.	Electrified Seed.	Gain or Loss due to Electrolytic Treatment.
	<i>grams.</i>	<i>grams.</i>	
Ca. 3000 Ears ..	5'9	11'0	Gain of 86'4 per cent.
Straw	15'7	17'0	" 8'3 "
Ca. 2998 Ears ..	4'7	6'0	" 27'7 "
Straw	13'7	16'8	" 22'6 "

Treatment ineffective.

Ca. 3002 Ears ..	11'7	11'4	None.
Straw	19'9	20'5	"

Treatment apparently disadvantageous.

—	Untreated Seed.	Electrified Seed.	Gain or Loss due to Electrolytic Treatment.
Ca. 2969 Ears ..	4'2	3'9	Loss of 7 per cent.
Straw	13'8	10'6	" 23 "
Ca. 2999 Ears ..	6'8	4'3	" 37 "
Straw	18'7	16'7	" 11 "
Ca. 3001 Ears ..	8'8	7'6	" 13'6 "
Straw	20'0	16'8	" 16 "
Ca. 3003 Ears ..	16'1	11'9	" 26'1 "
Straw	17'7	14'3	" 19'2 "

Out of 14 measurements in these seven different cases only four are in favour, whilst eight are against the process. It is obvious, therefore, that while a farmer using treated seed might be fortunate and obtain such a result as is shown by No. 2,998 or No. 3,000, he stands a much greater chance of gaining nothing, or even apparently of losing.

As an objection to this series of experiments it might be urged that too long an interval had elapsed between treatment of the seed and sowing. Such an objection would of course be a drawback to the treatment. In the case of winter corn one can never be sure of sowing directly the seed arrives, or even soon after : there is always the possibility of being caught by the weather. In another series of experiments, however, made by Professor Somerville at Oxford, this objection does not hold, as the seed, also treated in December, was sown on 15th, 16th, and 17th January. The results were:—

Treatment apparently advantageous.

—	Untreated Seed.	Electrified Seed.	Gain or Loss due to Electrolytic Treatment.
	<i>grams.</i>	<i>grams.</i>	
Ca. 2998 Grain	10'6	15'6	Gain of 47'2 per cent.
Straw	48'4	58'9	" 21'7 "
Ca. 3003 Grain	6'8	13'1	" 92'6 "
Straw	26'7	36'4	" 36'3 "

Treatment apparently ineffective.

Ca. 3001 Grain	9'9	10'2	None.
Straw	51'6	57'8	Gain of 12'0 per cent.
Ca. 3000 Grain	11'0	12'3	" 11'8 "
Straw	52'1	45'2	Loss of 13'2 "
Ca. 2999 Grain	9'1	10'4	Gain of 14'3 "
Straw	40'4	39'1	Loss of 3'2 "
Ca. 2969 Grain	8'6	7'6	" 11'6 "
Straw	30'9	32'9	Gain of 6'5 "

Treatment apparently disadvantageous.

—	Untreated Seed.	Electrified Seed.	Gain or Loss due to Electrolytic Treatment.
Ca. 3002 Grain Straw	12·6 53·6	7·4 42·1	Loss of 38·3 per cent. „ 21·5 „

As there were only two pots in each set it is doubtful whether differences below 10 per cent. possess any significance. Differences below 5 per cent. are disregarded, as they are certainly within the error of the experiment.

These results are, perhaps, a little more favourable than those obtained at Rothamsted, and they are also more favourable than other results obtained at Experimental Stations. They do not, however, hold out any particular promise. Of the seven different sets, two are apparently distinctly favourable : four are doubtful. This, again, is not at all the kind of result obtained with manures, and the result agrees with the results obtained at Rothamsted in showing that the process, if it has any value, belongs to the category of uncertain methods of treatment which may or may not succeed in any given case.

Field Experiments.—As the pot experiments have shown so little promise, no field experiments have been made at Rothamsted. Some field experiments have, however, been made at the South-Eastern Agricultural College, Wye, during the season 1918–19, by Mr. Lindsay Robb, who has furnished the following figures showing the yields per acre :—

Crop.	Untreated Seed.	Electrified Seed.	Gain due to Electrolytic Treatment.
<i>Barley.</i>			
Grain (saleable) .. bush.	35·75	34·75	None.
(light)	7	8	None.
Straw and chaff .. cwt.	34	33	None.
<i>Oats (Abundance).</i>			
Grain (saleable) .. bush.	38·12	36·75	None.
(light)	9	7	None.
Straw and chaff .. cwt.	36	35	None.
<i>Oats (Black Tartarian).</i>			
Grain (saleable) .. bush.	33	34·75	None.
(light)	8	3	None.
Straw and chaff .. cwt.	30	30·5	None.

These results are quite in accordance with those of the pot experiments.

Two other trials with barley gave similar results:—

Crop.	Untreated Seed.	Treated Seed.	Gain due to Electrolytic Treatment.
Little Snoring (supervision of Cambridge University)—			
Head Corn	5 coombes 5½ stone	5 coombes 4 stone	None
Tail corn	5 "lb.	6 "lb.	None.
Cambridge University Farm—			
Crop weight per row (a) ..	121·5	121·6	None.
(b) ..	94·1	92·0	None.

Farmers' Tests.—A number of farmers are said to have used electrified seeds and to have expressed themselves as satisfied with the result. Unfortunately, few actual results are available. In two cases weighings have been sent in to the Food Production Department. The results are as follow:—

Essex—Barley, after Roots fed off with Sheep.

Crop.	Untreated Seed.	Electrified Seed.	Percentage Variation in Electrified Seed.
Barley Grain ..	46·7 lb.	21·3 lb.	Loss of 54 per cent.

Hampshire—Wheat: Yield per Plot (20 sq. yd.).

Heads.	Untreated Seed.	Electrified Seed.	Percentage Variation in Electrified Seed.
Heads	14 lb. 4 oz.	14 lb. 7 oz.	None.
Straw	12 lb. 4 oz.	13 lb. 14 oz.	Gain of 12 per cent.

In a single trial of this sort it is impossible to lay any stress on a difference of 12 per cent.

The following weighings of the crop harvested in 1918 were made on farms in Dorsetshire selected from a list supplied by the County Executive Officer. The selection was made and the weighings carried out by one of the assistants at the University College, Reading. The weights may be accepted as reliable:—

Crop.	Untreated Seed.	Electrified Seed.	Gain or Loss due to Electrolytic Treatment.
<i>Wheat—</i>			
(1) <i>after tur-</i>			
<i>nips fed off</i>			
Grain ..	5 qr. 40 lb.	5 qr. 480 lb.	Gain of 17 per cent.
Straw ..	29 cwt. 32 lb.	57 cwt. 96 lb.	" 98 "
(2) <i>after</i>			
<i>swedes fed off</i>			
Grain ..	2 qr. 112 lb.	3 qr. 8 lb.	Gain of 36 per cent.
Straw ..	27 cwt. 56 lb.	26 cwt. 8 lb.	Loss of 5 "
<i>Barley—</i>			
(1) <i>after</i>			
<i>swedes fed off</i>			
Grain ..	4 qr. 88 lb.	6 qr. 92 lb.	Gain of 48 per cent.
Straw ..	33 cwt. 64 lb.	42 cwt. 76 lb.	" 27 "
(2) <i>after</i>			
<i>wheat</i>			
Grain ..	5 qr. 10 lb.	4 qr. 428 lb.	Loss of 3 per cent.
Straw ..	34 cwt. 62 lb.	36 cwt. 68 lb.	Gain of 6 "
<i>Oats—</i>			
(1) <i>after</i>			
<i>swedes fed off</i>			
Grain ..	3 qr. 232 lb.	5 qr. 320 lb.	Gain of 61 per cent.
Straw ..	23 cwt. 104 lb.	33 cwt. 64 lb.	" 40 "
(2) <i>after</i>			
<i>swedes fed off</i>			
Grain ..	4 qr. 316 lb.	7 qr. 128 lb.	Gain of 49 "
Straw ..	49 cwt. 52 lb.	44 cwt. 72 lb.	Loss of 10 "
(3) <i>after ley</i>			
Grain ..	9 qr. 96 lb.	10 qr.	Gain of 8 per cent.
Straw ..	63 cwt. 64 lb.	67 cwt. 16 lb.	" 6 "

In the above table the weights per qr. are: wheat 504 lb., barley 448 lb., and oats 336 lb.

There is a striking difference between these results, from selected farms, and those obtained elsewhere: out of 7 cases 5 are positive. Two important considerations, however, have to be borne in mind.

1. The 7 cases were not all in which electrified seed was used: cases were rejected where there were indications of soil or crop irregularities. As we do not know the total numbers of successes and failures, it is impossible to say whether or not the results agree with those of the pot experiments. Supposing, for example, that there had been altogether 18 cases, but that the other 11 had given negative results, then the proportion of successes would have been the same as in the Oxford pot experiments. Without knowing the total number of sowings and how many of these gave negative results, it is impossible to say what these figures really mean.

It will be noticed, however, that in all the cases where marked successes are recorded the crop has been grown after roots fed off. This is the worst possible treatment for

experimental ground, as the land is left in a condition seriously lacking in uniformity. Crops taken after wheat or after ley, where greater uniformity in soil condition can be attained, showed no benefit from the treatment.

The writer is not, therefore, prepared to admit that these figures seriously conflict with the conclusions drawn from the pot experiments.

Seven results were sent in for crops harvested on farms in Dorsetshire in 1919. Again the weighings were made by a disinterested competent person and may be accepted, and the selection of farms was made by him from a list submitted by the proprietors. The plots weighed were usually 1 sq. perch, but in two cases they were 2 sq. perches. It is well established that single plots will not with certainty reveal differences of less than 10 per cent. or 12 per cent. The results are :—

Treatment apparently advantageous.

Crop.	Untreated Seed.	Electrified Seed.	Gain or Loss due to Electrolytic Treatment.
<i>Wheat—</i>			
(1) Grain, bush.	51	68	Gain of 33 per cent.
Straw, cwt.	40	59	" 47 "
(2) Grain, bush.	32	40	" 25 "
Straw, cwt.	26	26	None.
<i>Oats—</i>			
(3) Grain, bush.	39	43	Gain of 10 per cent.
Straw, cwt.	16	19	Gain of 18 per cent.

Treatment apparently ineffective.

<i>Wheat—</i>			
(1) Grain, bush.	35½	39	Gain of 10 per cent.
Straw, cwt.	30	28	None.
(2) Grain, bush.	41	42	None.
Straw, cwt.	28	27½	None.
<i>Oats—</i>			
(3) Grain, bush.	37	36	None.
Straw, cwt.	22	21½	None.

Treatment apparently disadvantageous.

<i>Barley—</i>			
(1) Grain, bush.	43½	36	Loss of 17 per cent.
Straw, cwt.	24	25	None.

Out of 7 cases 3 show no difference, and 1 a small gain; 2 show distinct gains and 1 a distinct loss. These results are entirely in accordance with those of the pot experiments; they indicate that the treatment cannot be relied upon to

give a successful result ; twice or possibly three times out of seven times it apparently succeeds ; once out of seven times it apparently does harm ; and in the remaining cases it does no good.

Possible Cause of the Successes.—It may be that the successes are purely accidental : on the other hand, they may be real, and the writer is inclined to think that they are. The process consists of three parts : soaking the seed in a solution of certain salts, submitting while still in the solution to an electric current, then drying at 110° F. Now it is well known that kiln-dried barley, especially after steeping, will germinate more evenly and satisfactorily than will ordinary barley. This is particularly the case if the barley contains any amount over 14 per cent. or 15 per cent. moisture, and it is also true even in a season like the present when the moisture content is below the average. Professor Stapledon has shown* that drying seed at 100° F. may improve its germination, unless germination is already very good. Anything that helps germination may be useful on land which has been folded and left in an unfavourable condition. It is possible that the drying in the treatment might be sufficient to help germination. Apparently in some cases the electrified seed made the better start. At Wye the young plants from the electrified seed, both of oats and barley, at first showed greater vigour than those from untreated seed, but the superiority soon vanished. This, however, is not usual : at Rothamsted no such difference was seen ; in Professor Stapledon's germination tests the treated seeds were not quite so good as were the untreated. Nevertheless, the occasional help to germination derived from one or other parts of the treatment may prove of value in certain field conditions, and thus lead to a better crop than would otherwise ensue.

It is impossible to prove a negative proposition : a few unexceptional positive results outweigh any amount of negative evidence and would show that the treatment had some merit.

The failure, however, of electrified seed to give any increase in yield under the carefully controlled conditions of an experimental station trial shows that the process lacks certainty. It cannot be compared in effectiveness with manuring, which succeeds nearly every time if properly done. The writer is not prepared on present evidence to say that the process never succeeds, but the risk of failure seems so great that the farmer should look upon it as an adventure which may or may not prove profitable.

* See this *Journal*, July, 1919, p. 364.

THE VALUE OF LUPINS IN THE CULTIVATION OF POOR LIGHT LAND.*

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IN various parts of England, especially in East Anglia, there are considerable areas of very poor light land, much of which had gone out of cultivation before the War owing to the fact that it is of poor quality. Land of this type is usually very deficient in lime, and in all other necessary plant foods. In many cases no grass seeds had been sown, but a natural herbage, chiefly sorrel and poor grass, was permitted to grow.

During the War, considerable areas of this light-land "grass" were ploughed up, either voluntarily or at the instance of the War Agricultural Committees. In many cases rye was sown on the newly ploughed-out grass, usually with a fair measure of success, and there can be no doubt that the Nation's food supply was thereby considerably increased, with very little expenditure of labour. The question now requiring an answer, however, is, how can this land be kept in cultivation, in face of a higher cost of production, and every prospect of a falling price for rye? Two alternatives may be noted: (1) the land may be cultivated, or (2) it may be left in a practically derelict condition, as it will not grow an appreciable quantity of grass.

The writer for some years has had an opportunity of observing the effects of the growth of lupins upon poor light land, and has come to the conclusion that they possess certain qualities which render them of great value to occupiers of this type of land. He also believes that their usefulness is not sufficiently appreciated in this country. It is hardly necessary to mention that lupins, in common with other leguminous crops, assimilate the free nitrogen of the air. They are, however, unique, in that they produce a luxuriant crop on extremely light land.

In Suffolk, at the present time, the only variety of lupins grown to any extent is the blue lupin. Southworth, in the "Cyclopædia of Modern Agriculture," states that yellow lupins have more succulent stems and larger leaves than the blue variety. He tested the two varieties, however, and, on the whole, obtained the better results from the blue lupins. The seed germinated better, and usually produced a better crop. It has been stated that the yellow lupin grows more slowly than the

* Résumé of a paper read at the British Association (Section M), September, 1919.

blue variety, so that the seed ripens late and is consequently more difficult to save.

Lupins are grown for seed, for ploughing in green, and for folding with sheep. No statistics exist of the area under lupins in this country, but there are probably from 1,000 to 2,000 acres grown annually in East Suffolk.

Sowing.—When grown for seed, lupins are sown at the rate of $1\frac{1}{2}$ to 2 bush. of good seed per acre in April or early May. When sown towards the middle of May there is danger, in Suffolk, that the seed may not ripen satisfactorily, and in late seasons difficulty is experienced in harvesting. Thus, in 1918, lupins sown in the middle of May could not be harvested in some cases until the middle of November. When the crop is intended for seed, the middle of April is probably the most satisfactory time for sowing.

One Suffolk grower, who lives near the sea, and whose land is therefore not so liable to spring frosts, sows in March. Further inland there is considerable danger from frost if sowing takes place too early. Lupins sown in April, however, do not often suffer from frost in East Suffolk, and when grown for seed it is probably better to sow in this month than risk a late harvest by postponing sowing until the middle of May. If sown in April or early May the lupins will, in an average season, be ripe by the middle of September.

When grown for ploughing in green, or for folding with sheep, the seed may be sown at any time up to the middle of July. Usually, however, lupins are sown by the end of June.

Cutting.—Lupins intended for seed may be cut with the binder in the same way as beans. They may also be cut with a side-delivery reaper, and harvested loose. The plants hang together very well, and this latter method of cutting has the advantage of saving string, and of avoiding wear and tear of the canvasses of the binder, which are liable to be somewhat damaged by the spiny pods of the lupins.

If the lupins are tied up, they are shocked in exactly the same way as beans. In Schouwen, in Zeeland, near the mouth of the Scheldt, Boodt* states that this crop is cut loose, allowed to dry partly, and then tied up and stooked, being subsequently placed in small stacks—the smaller the better—on a base of brushwood.

From 20 to 30 bush. of seed per acre is an average crop. This must be regarded as good, when one considers the type of land upon which lupins are grown.

* *Tijdschrift der Ned. Heidemaatschappij*, March, 1918.

General.—It is worthy of note that Boodt* states that in Drente (North Holland) a gravel soil poor in humus and plant food is chosen for lupins. This soil in the late summer becomes so dry that the lupin plant dies about the middle of August. Better land is not suitable in Holland, because, especially in a wet summer, the plant continues growing too long, and its seed never ripens. In Schouwen, lupins are grown on the poorest and worst soils at the foot of the dunes.

Provided sufficient moisture is present, the plant makes a most luxuriant growth, the foliage having a characteristic dark-green hue. Even on the poorest of light land the writer has often seen a field of lupins one dense mass of green material $3\frac{1}{2}$ to 4 ft. high.

In a communication sent to the Royal Agricultural Society,† Mr. Thomas Crisp, of Butley, Suffolk, called attention to remarkable results he had obtained on poor light land by growing lupins.

Mr. Crisp was sent a sack of blue and a sack of yellow lupin seed by Baron von Nathusius of Hundisburgh, Prussia. He drilled, in 1858, one bush. of seed per acre on poor blowing sand, and in the following year, from 18 acres under lupins, he obtained 50 wagon-loads of sheaves. Mr. Crisp was of the opinion that yellow lupins are better for hay, straw, and chaff, and that the blue variety is better for seed.

Baron von Nathusius stated that in Prussia he sowed yellow lupins in June, ploughing in green, or folding with sheep. He found that the blue lupin makes excellent hay, but is difficult to dry. He also stated that the seed of both varieties was found to make excellent food for sheep and that the straw and chaff was of value for store sheep. He gave the following analysis of lupin seed:—

Water	..	..	..	..	..	14-15 per cent.
Fatty matter	..	..	..	..	..	6-7 "
Nitrogenous substances	..	..	..	..	..	33-36 "
Starch	..	..	..	..	..	26-30 "
Woody fibre	..	..	..	..	..	11-12 "
Mineral matter	..	..	..	..	..	3-4 "

In the *Journal of the Royal Agricultural Society*, 1896, Dr. Bernard Dyer gave an account of experiments conducted by Dr. Schultz, of Lupitz, Saxony. Dr. Schultz worked at the problem of improving a poor sandy soil, which contained from 0.18 to 0.26 per cent. of lime, and succeeded in greatly increasing

* Loc. cit.

† *Jour. of the Roy. Agric. Soc.*, 1859.

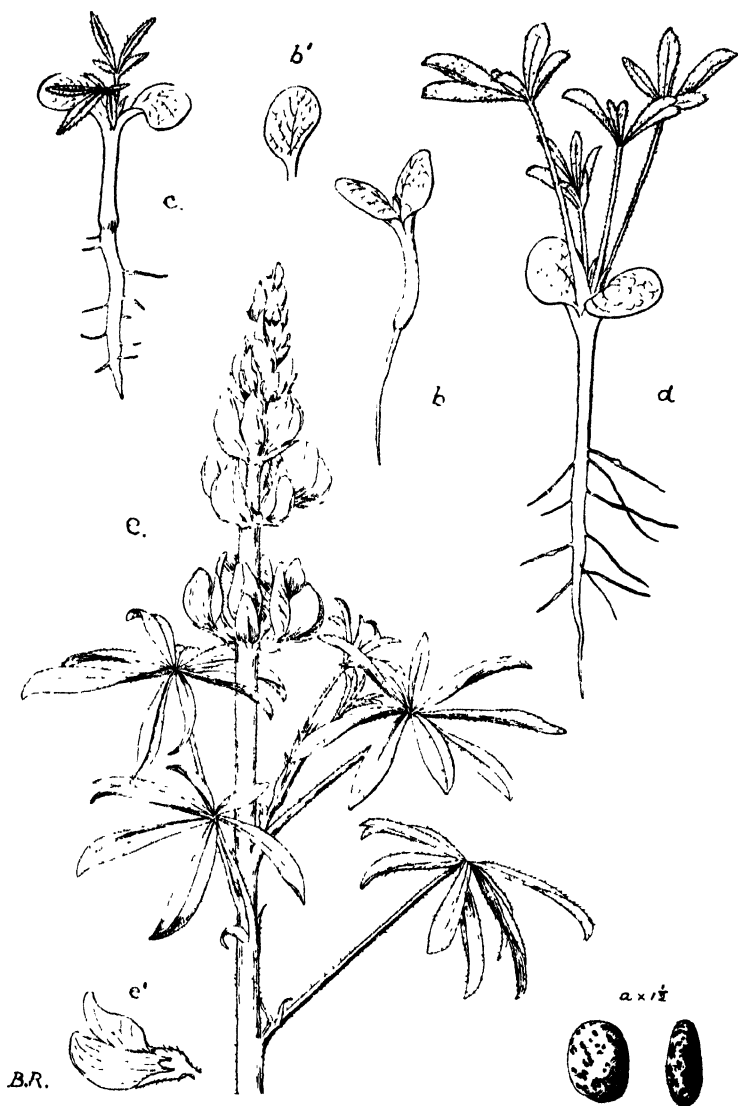


FIG. 1.—Blue Lupine (*Lupinus luteus*): a. Seed $\times 1\frac{1}{2}$; b. Seedling; b'. Cotyledon; c. Second stage of Seedling; d. Third stage of Seedling; e. Flowering Plant; e'. Flower $\times \frac{1}{2}$.

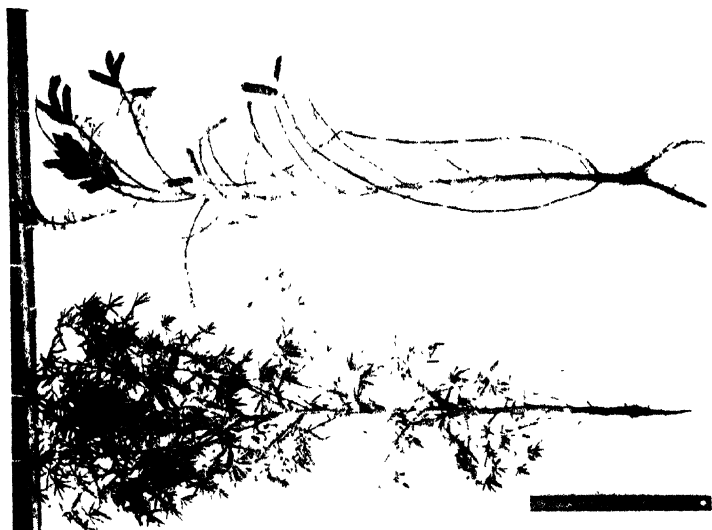


FIG. 2.—Lupin Plants (*a*) in flower, (*b*) with ripe pods.



FIG. 3.—A field of Lupins. In the foreground a portion of the crop has been ploughed under.

its productivity. Lupins were grown, alternating with non-leguminous plants, and to the latter, although not to the lupins, mineral manures, lime, phosphates and potash were applied. Part of a field was treated as a permanent lupin enclosure, blue lupins being grown on it continually for 25 years. The remaining part of the field was cropped with rye and potatoes. At the end of the period there was 0.087 per cent. of nitrogen in the lupin portion of the field and 0.034 per cent. on the portion where rye and potatoes were grown. Dr. Schultz estimated that a crop of blue lupins would contain as much nitrogen as 9 to 15 tons of farmyard manure. In one case, on the Lupitz estate, part of a field was planted with lupins which were ploughed in green, the lupins being sown after harvesting rye. Another part of the field was treated with about 8 tons of farmyard manure, and no lupins were grown. Potatoes were planted on the whole field next spring, and they gave the following results :—

	<i>Potatoes grown after Lupins ploughed in.</i>	<i>Potatoes grown with 8 Tons Farmyard Manure per Acre.</i>
Depth of penetration of the roots	47 in.	15 to 17 in.
Yield of potatoes per acre ..	9 tons.	6 tons.

In another case at Lupitz, rye was grown after lupins and potatoes, with the following results :—

	<i>After Lupins ploughed in.</i>	<i>After Potatoes heavily manured with Artificials.</i>	<i>On poor, recently arable Land not having lately borne Lupins.</i>
Height of rye above ground	47 to 66 in.	27 to 37 in.	20 to 25 in.
Depth of roots	45 in.	20 to 24 in.	16 in.
Yield of grain in bush. per acre (English) ..	27 bush.	12 bush.	9½ bush.

In Suffolk it is found that excellent crops of rye and frequently of oats can be grown on extremely poor, light and somewhat acid soil, after lupins which have been either folded green, ploughed in, or harvested for seed. One extensive grower, Mr. John Goddard, of Tunstall, maintains that lupins and rye could be grown on this type of land alternately for an indefinite period. Boodt also mentions that in Schouwen, this lupin rye rotation is practised successfully. Excellent crops of lupins have been observed repeatedly on land which is very poor in lime, and on which both sorrel and spurrey grow abundantly. Very few Suffolk farmers appear to have applied mineral manures to lupins, so that the question of permanently improving the fertility of the soil by this means cannot be said to have been

investigated properly in this country. The writer, in 1918, was instrumental in arranging for the application of a neutral phosphate to about 30 acres of lupins on Hinton Hall Farm, Suffolk—no potash was available owing to the War. An excellent crop of lupins resulted, and the land grew a good crop of rye in 1919.

As previously mentioned Boodt* states that in Drente an application of 4 cwt. of basic slag, and 4 cwt. of kainit per acre is found suitable as a first dressing, smaller quantities being given in subsequent years. If the soil is poor in potash more kainit should be given, as lupins greatly need potash. Boodt states that when lupins are sown for the first time in Holland, the soil requires inoculation at the rate of about 4 loads of soil, in which lupins have previously grown, per acre. This practice does not appear to have been adopted in East Anglia, and on land which has not so far as it is known grown lupins before, excellent crops have resulted without inoculation.

In Suffolk, as already stated, lupins are either ploughed in green, folded with sheep, or the seed is harvested.

During the past season (1919) the writer has seen excellent crops of rye grown after lupins ploughed in, on poor, light, sandy land adjoining the heath.

The experience of a few farmers in the cultivation of lupins may be given:—

Mr. A. M. Rope, of Leiston, Suffolk, states that he ploughed up very poor land, which had been abandoned for some years, in May or June, that he drilled lupins across the furrows, and obtained a good heavy crop and excellent rye afterwards. He has now a second crop of rye, looking fairly well, on the land. He agrees that one may grow lupins and rye alternately for some years until the land becomes too full of couch. The land in question is too poor for turnips to be grown fit for feeding to sheep.

Mr. Rope has never sown lupins so late as August, but he thinks that if sown in this month they might answer for ploughing in green provided the seed be cheap. He has often sown in June or July, after folding rye or vetches, or after working the land to clean it of couch grass. The heavy smothering crop of lupins which follows helps to keep the land clean. Mr. Rope finds that folding a good crop of lupins leaves the land in very good heart for a crop of rye. He considers that lupins will grow quite well where, owing to the absence of lime, the land is definitely acid.

Opinions are divided as to whether, from the standpoint of the succeeding crop, it is best to harvest the lupins for seed, to plough them in green, or to fold them with sheep. Mr. J. R. Grimsey, of Leiston, and Mr. F. W. C. Chartres, of Willingham, Beccles, both with extensive experience of lupin growing, consider that the best results are likely to be obtained when the seed is harvested. Mr. John Goddard, of Tunstall,

* Loc. cit.

another large grower, considers that it does not matter very much whether the crop is ploughed in green, folded or harvested. Mr. A. M. Rope, of Leiston, favours folding, but he has never ploughed in lupins green. Mr. H. P. Skeet, of Blaxhall, strongly favours ploughing in green, as compared with other methods, the lupins being drawn under the soil by means of a chain. Mr. Skeet is a great believer in ploughing in green leguminous crops as a means of improving poor, light land. He finds that comparatively little benefit to the succeeding crops results from the manure made by sheep on light land when the weather is hot, especially during July and August.

During the summer of 1919 the writer inspected two fields near Martlesham Heath, owned by Mr. E. G. Pretyman, M.P. On the first field, near the Heath, the lupins were ploughed in, whilst on the second they were harvested. The rye on the latter field was not nearly so good as that on the former field.

The question as to which proceeding is best to adopt—ploughing in green, folding, or harvesting—is one which requires further investigation. When a ready market exists for the seed, harvesting is almost certain to give the best financial results. In many cases, however, the land may require cleaning, or it may be occupied by another crop, so that it is impossible to sow the lupins early enough for the seed to ripen. In such cases folding or ploughing in green may be relied upon to improve the land considerably.

Composition of Lupins.—Very few British analyses are available. Those given by Kellner indicate that in composition green lupins resemble green vetches, but have a somewhat larger proportion of woody fibre. The grain of blue lupins contains a somewhat larger proportion of albuminoids (29 per cent.) than do beans, which only contain 25 per cent. of albuminoids. The fat content is higher than in beans, being 6 per cent. as against 1.5 per cent. in the latter. The starch equivalent is also slightly higher in the case of lupins than in beans.

Use for Feeding Purposes.—One of the difficulties in the past, in connection with the growing of lupins for seed, has been the disposal of the seed produced. The demand for the seed is limited, and hitherto no very satisfactory method of utilising it as cattle food has been found. Mr. John Goddard feeds it to sheep— $\frac{1}{2}$ bush. of lupin seed daily per 100 sheep—*i.e.*, about $\frac{1}{2}$ lb. each. This, in his experience, is the extreme quantity which can be fed safely. More than this causes paralysis. The grain is bitter, and is refused by other stock.

Mr. Goddard does not use lupins for pregnant ewes, nor does he consider them suitable for feeding to these animals.

Mr. Rope, of Leiston, has fed lupin seed to sheep, but would not venture to feed more than $\frac{1}{2}$ lb. per head daily.

Many flockmasters in Suffolk find lupins very useful for folding purposes. Sheep do well on them, especially when the seed is beginning to form in the pods, but before it gets hard. If the lupins are sown in June, the pods remain on until December, and are good feed for sheep, even when the plant is nearly black. The animals, however, take some time to get accustomed to the bitter flavour, and one should always begin gradually the feeding of lupins. Sheep also require a run on rough grass or on the heath daily, returning to the fold at night.

Possible Poisonous Properties of Lupins.—Considerable care must be taken in folding lupins, to prevent the animals from eating too large a quantity at once, or a heavy mortality may occur. Kellner* states that fodder from lupins always has a heating effect, and in some years all parts of the plant contain a deadly poison. This poison, he states, is a protein-like substance, probably due to the action of some fungus, which, favoured by the weather, migrates to the plant. He recommends feeding the lupins to a rabbit or similar animal in order to judge whether the material is safe. Steaming for four or five hours under a pressure of 60–80 lb. per square inch is, he states, necessary to destroy the poisonous properties.

The writer has been unable to trace any instance, in Suffolk, of serious poisoning from feeding green lupins. Most flockmasters using them fold with confidence, provided certain precautions are taken. Kellner appears to over-emphasise the danger of poisoning. At the same time there can be no doubt that some danger exists and that great care is necessary. If, however, lupins are mixed with other plants, such as tares and oats, the danger is small.

Whilst chemists have shown the presence of poisonous alkaloids in lupins, the losses to stock in Northern Germany in consequence of feeding lupins have been considered by certain investigators (Kuhn, Roloff, Arnold and Lemke, Arnold and Schneidemuhl, Damman), as due, not to the alkaloids, but to a hypothetical substance, known as *ictrogen*.

An investigation by Dr. Sellman† showed the presence of alkaloids in American lupins, and pointed to the probability that most, if not all, of the poisoning of live stock in America by lupins, was due to these alkaloids, and not to *ictrogen*. These

* Kellner, O., The Scientific Feeding of Animals, p. 165. Trs. W. Goodwin.

† Lupins as Poisonous Plants, Marsh, C. D., Clawson, A. B., and Marsh, Hadleigh, U.S. Dept. of Agric., Bull. No. 405, Washington, 5th December, 1916.

alkaloids are toxic, or fatal, if a sufficient quantity of the plant is consumed, but they are harmless if the consumption is below a certain limit ; up to this point the lupins may be a useful food if precautions are taken that the limit is not exceeded. The alkaloids can also be largely removed by leaching with water. The author states that the actual cause of death when it occurs from lupin poisoning is paralysis of respiration. In the treatment of lupin poisoning, good results were obtained from potassium permanganate and from tea. All parts of the lupin plant examined were found to be poisonous, the seed being most toxic. The investigation showed that the toxic substance is excreted by the kidneys, and that the intoxication is not cumulative.

Animals may eat comparatively large quantities with no evil results if the toxic limit is not reached at any one time. Poisoning can be avoided by careful handling of the flocks, and by special care being taken to see that hungry sheep are not grazed on fields where there is much lupin.

These latter observations agree with the experience of Suffolk flock-masters. Thus Mr. A. M. Rope, of Leiston, who has had extensive experience of folding lupins, states that he has never lost any sheep through lupin poisoning. He finds, however, that it is important to begin folding lupins gradually, especially if much seed be present in the green pods. If feeding be not begun gradually, the sheep become paralysed. He considers that it is important not to put hungry sheep on lupins, and that the sheep are not so liable to "blow," or become distended with wind, on lupins as on coleworts, or on a clover-ley. Mr. Rope is not in the least afraid of poisoning when folding lupins.

Mr. H. Fulcher, of Hazlewood Hall, considers that it does not matter very much whether the lupins are in the late-flowering stage or in the pod when folded, but his shepherd prefers a few pods. Sheep on his farm have often become paralysed through eating lupins, but they have always recovered. He finds that sheep must not be allowed to feed on lupins for long at a time, but that it is better to give them a short time on the fold at first, and gradually to extend the time. Mr. John Goddard, of Tunstall, finds that sheep become very fond of lupins, and unless care is exercised, they eat too much.

Mr. John Goddard sows a mixture of oats, tares and lupins. An excellent crop of similar mixture, with a few coleworts added, was seen by the writer on Mr. H. Fulcher's farm, on a field recently reclaimed from the heath. When a mixture of this kind is fed, it would appear that practically all danger of lupin poisoning disappears, as the sheep cannot eat enough lupins at once to cause trouble.

Mr. H. P. Skeet finds that a mixture of lupins, oats, and coleworts makes an excellent fold for lambs. He does not consider it desirable to fold pregnant ewes on lupins as the lupins are heating, and trouble at lambing time from sore teats and bad feet is likely to ensue. When fed to sheep in the summer, Mr. Skeet considers that lupins help to expel intestinal worms. As far as the writer is aware, the only farm

animals which are fed with lupins, in Suffolk, are sheep. Rabbits and hares bite them off, but do not eat them to any extent when green. They are very fond of them when in the stack, however, and will visit a stack regularly for the purpose of feeding.

The safest plan when feeding lupins to sheep is to ensure that lupins form only a portion of the diet, allowing the animals a good feed of some other material daily, and that they do not eat too many lupins at once. Sheep cannot live satisfactorily on lupins alone.

Lupin Hay and Silage.—The writer is not aware of any case in which lupins have been made into silage in this country, but they seem very promising material for that purpose. It is, however, hoped to investigate the matter. Kellner gives several analyses of lupin silage and lupin hay. No case has been observed by the writer, however, where hay has been made from lupins in this country: as already stated, lupins are dried with some difficulty.

Removal of Poisonous Properties.—Boodt* has described a method for removing the poisonous substance contained in lupins. A vat is half-filled with lupins and water is then poured in up to the brim, the whole being left to stand for 24 hours. The lupins are then placed in another vat full of fresh water, boiled for 3 hours and left to cool for 12 hours. They are again removed to another vat containing fresh water, where they remain for a further 12 hours, when they are crushed. Boodt admits that this process is not very rapid, but points out that it is necessary to proceed cautiously in order to avoid the slightest trouble on feeding. After crushing, the lupins are mixed with finely-chaffed oat-straw, and the mixture forms an excellent food for cattle.

In Schouwen lupin grain is stated to be fed to horses, with the straw, without any soaking or other treatment.

It occurs to the writer that if some method of soaking and crushing such as that outlined above were found successful in eliminating the poisonous properties of lupins, the resulting product might very well be dried and placed on the market as a cooked crushed food, as is extensively done in the case of cooked flaked maize. The matter is of considerable importance, for lupins, if grown for seed for which a ready market existed, might easily take the place on light land which beans occupy on heavy land. They are easily grown, give excellent crops, with little or no manure, and, on the light land for which they are suited, exercise a marvellous effect upon the succeeding crop.

* *Loc. cit.*

The last characteristic is doubtless due to the large quantity of nitrogen which they accumulate from the air, and to their extensive root system which opens up the soil to less strongly-rooted plants. The question of the commercial utilisation of lupin seed, however, has not yet, as far as the writer is aware, been investigated in this country.

Conclusion.—After a consideration of all the facts observed in the cultivation of lupins the writer has come to the conclusion that their value as a means of improving and reclaiming poor light land is not yet sufficiently appreciated in this country. The effect of a crop of lupins upon the succeeding crop is really astonishing. Lupins grow with surprising luxuriance upon poor, blowing sand, which will grow practically nothing else but rye. The high cost of cultivation is causing farmers to consider carefully what proportion of their land it will pay them to cultivate. It is, therefore, of the greatest importance that any crop which seems to possess properties which make its cultivation on certain soils especially suitable should be carefully studied, and the results obtained from its cultivation made known as widely as possible.

In conclusion, the writer wishes to express his indebtedness to the gentlemen mentioned in this paper, for the very valuable information they have so kindly given him, and also to Mr. Fred Smith, of Woodbridge, who has kindly read through this article. Mr. Smith has had extensive experience with lupins, and has expressed his agreement with the general conclusions arrived at.

THE FOOD OF THE NIGHTJAR

(*Caprimulgus europæus*, Linné).

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University of St. Andrews.

THE Nightjar, known more commonly also as the Fern Owl, Churn Owl, Night Hawk, Spinner, Wheel-bird, and by the absurd name of Goatsucker, is a summer visitant to this country. It arrives from its African winter retreat usually about the first or second week in May, and departs, as a rule, about the middle of September, though both earlier appearances and later departures are known.

Like many other crepuscular and nocturnal animals, this bird is regarded with a large amount of suspicion, and many superstitions are associated with it. In some parts of the country it is still believed to be a hawk, and a foe to the poultry yard and to young game birds.

Writing of this bird in 1908, Archibald* states, "it is unfortunate that some unwise person once gave the name of Night Hawk to this species; the designation has been quite enough to cause unintelligent game-preservers, by no means a limited class, to destroy these delightful birds. A glance at their soft bills and feeble feet renders the idea that they take game as ridiculous as the fable that they suck the milk of cows and goats."

In both Warwickshire and Yorkshire the writer has seen specimens nailed up in the "gamekeeper's museum." Moreover, we have a considerable amount of evidence to show that during the past twenty years this bird has seriously diminished in numbers, no longer occurring in localities where it was once common. This is most unfortunate, for there are few birds which are more harmless, or which render better service to the farmer and the fruit grower.

As the Nightjar lays only two eggs, its increase is not rapid, even supposing that in some parts of the country there are two broods.

Practically every writer on ornithology during the last fifty years has endeavoured to dispel the absurd superstitions that have been associated with this very beneficial bird. All are agreed upon the nature of its food, but hitherto we have not possessed any exact and detailed information as to the actual food items or the percentages of such items, and these are now offered in the hope that the Nightjar will be more carefully

* *Jour. Roy. Agric. Soc.*, 1908, Vol. 68, p. 9.

preserved and more strictly protected by the agricultural community.

For the purpose of this investigation the writer has not deemed it necessary or desirable to destroy a large series of specimens in order to obtain a truer estimate of the food. Examples have been obtained from seven widely separated localities, and an average of two specimens per month has been examined for the months of May to September, as shown below :—

Locality.	May.	June.	July.	Aug.	Sept.	Oct.	Totals.
1	1	2	2	2	2	—	9
2	—	2	2	2	2	1	9
3	1	2	2	2	2	—	9
4	1	2	2	2	2	—	9
5	1	2	2	2	2	—	9
6	1	2	2	2	2	—	9
7	—	2	2	2	1	1	8
Totals	5	14	14	14	13	2	62

The whole of the food found in these 62 specimens consisted of animal matter, and this was entirely of an insectivorous nature. So far as the writer has been able to ascertain, by careful and continued observation extending over a number of years, practically the whole of the food is taken whilst the Nightjar is on the wing.

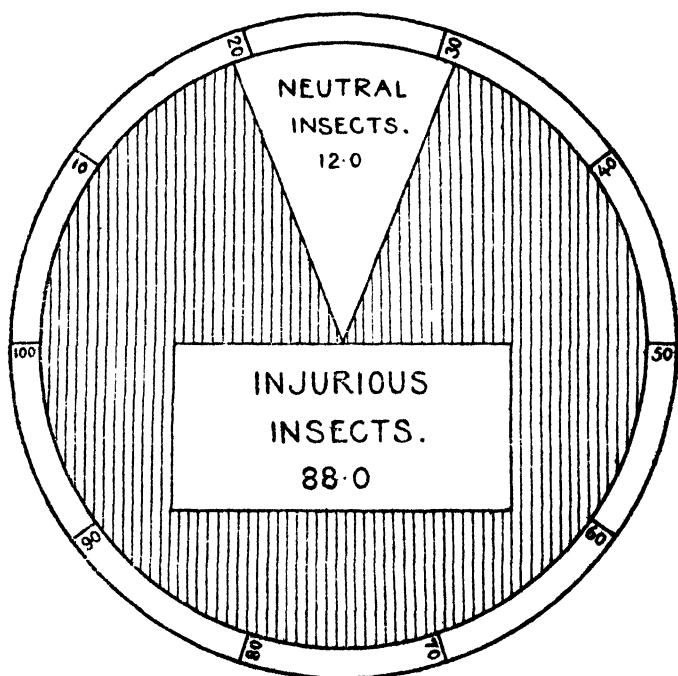
The various items found in the stomachs of the 62 specimens were as follow :—

	Per cent.
Ghost Moth (<i>Hepialus humuli</i> , L.)	13'5
Garden Swift Moth (<i>Hepialus lupulinus</i> , L.)	2'5
Winter Moth (<i>Cheimatobia brumata</i> , L.)	1'5
Cabbage Moth (<i>Mamestra brassicae</i> , L.)	1'5
Turnip Dart Moth (<i>Agrotis segetum</i> , Sch.)	2'5
Heart and Dart Moth (<i>Agrotis exclamationis</i> , L.)	5'5
Great Yellow Underwing (<i>Triphæna pronuba</i> , L.)	3'5
Remains of Moths (not identifiable)	18'5
Cockchafer (<i>Melolontha vulgaris</i> , Fabr.)	10'5
May Beetle (<i>Phyllopertha horticola</i> , L.)	5'0
June Chafer (<i>Rhizotrogus solstitialis</i> , L.)	4'5
Dung Beetles (<i>Geotrupes</i> sp.)	1'5
Remains of Beetles (not identifiable)	16'5
Crane Fly (<i>Tipula oleracea</i> , L.)	5'5
Remains of other Dipterous Flies	7'5
	<hr/> 100'0 <hr/>

A summary of these figures shows that of the total bulk of food consumed from May to September 88 per cent. consists

of insects harmful to agriculture, while 12 per cent. consists of insects of a neutral character (see Figure).

Little need be said as to the harmful insects. All are common and widely distributed species, and amongst the most injurious pests with which the farmer and fruit-grower have to contend. Some, *e.g.*, the Cockchafer, May Beetle, and June Chafer, are exceedingly difficult to deal with, especially when attacking a large acreage of crops, and were it not for the good offices of the Nightjar and a few other wild birds there is little doubt but that the losses occasioned by these insects would be of a very serious nature.



Diagrammatic Representation of the Percentages of Food of the Nightjar.

The actual number of insects destroyed is very difficult to estimate, but it may be of interest to cite the stomach contents in a few cases. In one bird, shot in the early morning in July, remains of 15 June Chafers, 67 Garden Swift Moths, 40 Turnip Dart Moths, and 8 Great Yellow Underwing Moths were present in the stomach. In a specimen shot in August, about 10 p.m., the stomach contained remains of 163 Crane Flies, in addition to fragments of numerous moths and beetles.

From long observation of the Nightjar and its habits we believe that it is very uncommon for this bird to feed during the day-time, although a few instances of day-time feeding are on record; nevertheless, the amount of food it takes from sunset to sunrise must be considerable. Digestion, we know, is fairly rapid, but in all the 62 birds examined there was only one of which the stomach was about three-quarters full; in the remaining 61 obtained between the hours of 10 p.m. and 4 a.m. the stomach was tightly packed with food only recently taken and the remains of food previously obtained.

In view of the very beneficial nature of this bird's work, farmers would do well for the general good and their own interest to use their utmost efforts to protect and preserve it.

As far as any future legislation is concerned, the Nightjar, and its eggs, should be protected during the whole of its residence in this country.

THE WARBLE FLY.

EVERY farmer is familiar with the barrel-shaped maggots that are often to be found in large numbers from January until May just under the skin on the backs of cattle. These maggots are the grubs of the warble fly. When present in large numbers they are the cause of enormous loss to farmers, much greater than is commonly realised. At a low estimate the annual loss in damaged hides alone is put at upwards of £500,000. This, however, is not the only damage they do. The butcher often finds the flesh beneath the "warbled" areas so altered by the inflammation set up that the beef is what is known as "licked" and is useless for human food.

Although the maggots are the chief culprits, the adult flies are by no means free from blame. When flying round on the lookout for a suitable place to lay their eggs they frighten the cattle, which rush about the field with their tails in the air. This "gadding" often causes the animals to lose condition and decreases the yield of milk in cows.

Kinds of Warble Flies.—There are two kinds of warble flies in this country; both are much like small bumble bees in appearance and fly in bright sunshine with a "hum" distinct but not loud. The larger warble fly, known scientifically as *Hypoderma bovis*, and generally more common, has whitish hairs over the front of the body and lemon yellow hairs at the tail, while the smaller kind, *H. lineata*, has the front region largely bare of hairs and a bright orange tuft at the tail.

Description and Life of the Pest.—The egg-laying season lasts from May until September, the smaller fly appearing first, and the larger one or two months later. As may be seen from Fig. 1, the eggs are of a rather curious shape. They are about one-twelfth of an inch long and each one has a grooved base by which it is attached to the hair of the animal. The eggs are laid by the female chiefly on the hind legs of the animal attacked and usually just below the heel joint or hock, more rarely on the flanks, and apparently never on the back. The larger fly, *H. bovis*, lays her eggs singly near the base of a hair, but the smaller one, *H. lineata*, places them in a row of seven or more half-way up a hair.

In four or five days the little maggots are hatched and at once enter the skin close to where the eggs were laid. At this stage the maggot is only one-thirtieth of an inch long, but it has relatively very strong sharp jaws and spines. Having bored into the skin the tiny maggots spend some time wandering through the system of the animal until they finally reach the wall of the gullet in which they are found embedded from September to January. They are now in the second stage, somewhat narrow and cylindrical, with feeble jaws and very few spines. After several months' residence in the gullet wall the maggots continue their wanderings and begin to appear under the skin on the back of the animal, sometimes as early as November and December, but much more frequently from January onwards. Here they enter upon the third stage of their existence; they become larger, thicker, and more spiny (Fig. 2). Each maggot lies in a small swelling, feeds on the fluid which arises from the animal's inflamed flesh, and breathes through a hole that is bored through the skin, the air openings at the maggot's tail end being immediately under this hole.

In late winter or early spring most of the maggots become fully grown and afterwards work their way out through the holes in the skin and fall to the ground. They have a large number of tiny sharp spines arranged in rows on their bodies, and these spines help their movements. Falling to the ground the maggot undergoes a change, its outer coat becomes hard, firm, and dark in colour (Fig. 3); for six weeks or so it remains motionless among the grass, or under a stone or clod, the insect being now in its resting or pupal stage. Then a round lid splits off from the front end and the fly comes out.

How to Destroy the Pest.—There is no evidence that the various washes and smears commonly recommended for use in summer are of any value in preventing flies from laying their



WARBLE FLIES.

- 1 *Hypoderma bovis*, Male 2 *Hypoderma bovis*, Female
 3 *Hypoderma lineata*, Female



Piece of tanned leather showing warble fly damage



FIG. 1.—Eggs of
H. Lineata.

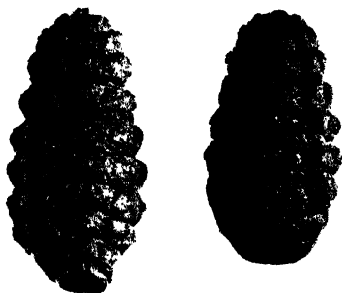


FIG. 2.—Full fed Larvæ of Warble Flies.



FIG. 3.— Puparia of Warble Flies.



FIG. 4 —Underside of a piece of skin showing
Warble Fly larvæ.

eggs on the cattle. Some protection may, however, be afforded by giving the cattle access to shade and water in which they can stand, and it is worth remembering that yearling and two-year-old bullocks and heifers are more subject to warble fly attack than young calves, and calves more than milch cows.

The most effectual method of exterminating the insects at present known is to squeeze out and destroy the ripe maggots, beginning early in May and continuing during June, July and August. Where several maggots are removed from a small area of skin, it is advisable to apply carbolic oil. Several types of "dip" and "smear" are of some value in killing warble maggots, but none is yet known to be so certainly deadly in its effect on the maggots, and at the same time harmless to the cattle, as to warrant its general recommendation as an alternative to the more troublesome but effective squeezing out operation, and it is the latter which is recommended for the present.

An appeal is made to cattle owners in their own interests to kill as many warble maggots as they possibly can, and not only to destroy the pest themselves, but to persuade neighbouring farmers to do the same, for unless the practice is general over wide areas the results will be disappointing.

Farmers do not seem to realise that they are themselves bearing a high proportion of the immense loss occasioned by warbles, as they are every year getting lower prices for their cattle than they would command if warbles were exterminated or even greatly reduced in number. Warbles are certainly troublesome pests to deal with, but if all farmers would, for any two or three years, take the necessary steps, there is no reason why the insects should not be almost exterminated. The higher prices which would then be obtained per beast would compensate many times over for the trouble taken in eradicating the pest.

(This Article is also issued as a Leaflet, known as A. 312/1. Copies may be obtained free of charge and post free on application to the Secretary, Ministry of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1. Letters of application so addressed need not be stamped.)

"STRIPE" DISEASE OF TOMATOES.*

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AND

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THE disease known as "Stripe" is of common occurrence in nurseries in this country, and at times it causes the grower considerable losses. During the early part of 1919 about 25 per cent. of the crop obtained from the experimental houses at the Cheshunt Station was so badly affected that it could be sold only as "seconds." "Stripe" disease has been known to cause complete loss of the crop in badly-infected houses. In 1910 some examples of plants attacked by this disease were received at Kew from two localities where it was stated to be present in epidemic form. Though stripe is mainly a disease of the forcing house, it has been observed in a garden where plants were grown in a position facing south and sheltered by a high wall. A similar disease, which is believed to be identical with stripe, has been reported from the United States and Canada, and was once found in the neighbourhood of Toronto on field tomatoes, of which about 1 per cent. were affected.

Description.—The symptoms of the disease are well marked; the main features are brown stripes on the stems, brown, sunken patches on the fruit, and brown, shrivelled areas on the leaves. The stem stripes or "blazes" may occur at intervals along the stem or, in bad cases, may be so numerous that no region of the stem is free from them; they vary from small, brown spots to long, sunken furrows, which often extend from the base of one leaf to the node below. The fruit "spots" are irregular sunken blotches of a light or dark brown colour scattered promiscuously over the surface of the fruit. The affected leaves at first show light yellow patches between the veins, which turn brown later and spread so that large areas are reduced to a dry, shrivelled condition, causing considerable distortion of the leaves.

The disease frequently occurs in the seed-bed, producing rapid destruction of the plants, and necessitating fresh sowings. Most commonly the disease does not show itself until the tops

* This account of the disease is an abbreviation of an article shortly to appear in the *Annals of Applied Biology*, Vol. VI., in which the disease and its causal organism are to be fully described.

are allowed to develop, although it is not unusual to find the disease in the spring when the first pickings are being made.

The plants are generally attacked underground, the causal organism being introduced into the cortex of the root or stem through wounds caused by biting insects. The aerial parts of the plants are likewise subject to infection through insect bites, and also by the organism being carried on to them by the pruning knife.

The organism travels through the stem in the parts of the pith adjacent to the vascular bundles, and is rarely to be found in the wood elements themselves. From the pith the disease passes by way of the medullary rays to the cortex, forming lesions in the outer cells and causing the sunken furrows to be formed at the surface. The attacked tissue becomes stained a dark brown colour and, on cutting the stem or petiole, the diseased patches can at once be recognised by the naked eye. The organism enters the fruit through the stalk and finds its way to the outside by channels which, when the fruit is cut open, can often be seen as narrow-brown streaks in the neighbourhood of the vascular bundles; in the same way the seed may become infected or, if not actually infected, since it has often been found in the loculus, the organism may be dried upon the seed coat so that on germination the young seedling may become infected.

The causal organism is a small, yellow bacillus closely related to, if not identical with, *Bacillus lathyri* (Manns and Taubenhaus), which causes a very similar disease in the sweet pea.

Varieties of tomatoes differ markedly in their susceptibility to the attack of this organism; " Kondine Red " and " Comet " were found to be much more affected than " Ailsa Craig " when grown on the same soil and under the same conditions. Generally, those varieties which show rapid, soft growth in the early stages are the most susceptible.

Manurial treatment has considerable influence upon the susceptibility of the plants. As has been frequently shown in connection with other diseases, excessive nitrogen and a lack of potash in the fertiliser tend to lower the resistance of the plant to the invasion of the parasite. The effect of too much nitrogen can be largely counteracted by an increase in the amount of potash.

Preventive and Remedial Measures.—I. Bacteria have been isolated from the loculi of tomatoes which before cutting showed very little sign of disease; hence, owing to the difficulty experienced in thoroughly removing the glairy coating from

the seed, it is highly probable that bacteria would become held in this substance as it dried round the seed, and on being released during germination would endanger the crop. Seed obtained from fruit grown in an infected area should not, therefore, be used.

2. The selection of a resistant variety should be aimed at.

3. Sterilisation of the soil by heat should be practised where an attack has occurred.

4. Excessive nitrogen and a deficiency of potash in the fertiliser should be avoided.

5. Special care in pruning should be exercised where the presence of the disease has been observed. While pruning an affected plant, and especially before passing from such a plant to its healthy neighbours, the pruning knife should be sterilised by wiping the blade with a cloth soaked in 2 per cent. lysol or some similar disinfectant. The prunings from an affected plant should be carefully collected and burnt.

6. In cases where infection has occurred on the upper part of a plant, removal of the attacked stem and the development of a lateral shoot will often lead to complete recovery and to a clean crop of fruit.

7. When plants in the early stages of growth are badly infected, further extension of the disease can be checked by so altering the conditions of heat and damping as to favour more hardy development. Under such treatment plants have been known to "grow out of" the disease, and to yield a crop of sound fruit.

THE following Note has been communicated to the Ministry by Mr. Alfred Wood, Secretary of the British Sugar Beet Growers' Society, Ltd. :—

**Home-Grown
Sugar.***

The work which the British Sugar Beet Growers' Society has been conducting at Kelham, near Newark, is now approaching a critical stage in its history. A Company is about to be formed for the purpose of carrying out at that place an experiment in sugar production on commercial lines. The public are now to be asked to take a part in this great work, since, owing to the recent severe reduction in their sugar allowance, they are thinking and talking a great deal about the position of the country with regard to

* See articles on cultivation of Sugar Beet in this *Journal* for January, 1911, p. 793, February, 1915, pp. 969 and 988, June, 1915, p. 210, November, 1915, p. 750, and March, 1916, p. 1210.

this important commodity. The capital of the Company is to be nominally £1,000,000 sterling, but only half of this is to be issued, and of this half the sum of £250,000 is to be taken up by the Government and £250,000 by the general public. For 10 years the £250,000 to be taken up by the Government will not rank for dividend until a 5 per cent. dividend upon the public capital has been provided for, and in no circumstances can the interest on the Government shares exceed 5 per cent. The dividend upon the public capital will be guaranteed by the Government for 10 years at 5 per cent.

It will be seen, therefore, that the Government are taking a very practical share in the work of establishing a sugar industry in England. The Company about to be formed will be exclusively British in capital and control. An important point is the fiscal advantage which home grown sugar enjoys over foreign imported sugar under the Finance Act of 1919. This advantage is very considerable. The home-grown article has a preference of more than £6 4s. per ton over the imported foreign article, and of nearly £1 19s. per ton over the very small amount of sugar which we receive from our Dominions and Dependencies. The price of sugar, even allowing for a heavy fall in the market, seems likely to remain high enough to justify a good price to the farmer for his roots, a satisfactory wage to the worker in field and factory, and a remunerative interest on the invested capital. The conditions are, therefore, all favourable, and the "infant industry" at Kelham will see the light in circumstances which ought to ensure to it a vigorous childhood and a long and prosperous life.

It is, perhaps, not generally known that England is nearly the largest consumer of sugar in the world. Even on the prices ruling before the War we consumed in the United Kingdom £25,000,000 worth of sugar every year. This is an immense market, and it is a pity that England should so long have dispensed with the social, economic and industrial benefits of this great and always increasing demand.

The first business of the new Company, when the capital has been contributed, will be to erect a factory at Newark on the estate at Kelham, not far from the Board's Land Settlement Colony. This factory will be placed on a site exceptionally favoured with transport facilities by river, road and rail.

Another important task before the Company will be to secure a sufficient acreage under sugar beet in the neighbourhood

of Newark to supply the factory with the sugar beets necessary for its full operation.

In conjunction with the Board of Agriculture, the Society has been preparing its estate at Kelham with a view to the cultivation of beet. The estate will serve as a central demonstration farm for local farmers. Even a single factory should bring manifold advantages to the neighbourhood in which it is placed, providing employment in summer in the fields and in winter in extracting and refining sugar, while it should create subsidiary industries and stimulate those already existing. The factory cannot be ready and the beets available during the present year. The opening campaign falls in the year 1921, by which time all the preparations should be complete.

It is hoped that the Kelham enterprise will prepare the way for many similar undertakings throughout the country, by providing an interesting and instructive object lesson in the methods of running a great sugar business. The promoters of the Kelham scheme include many agriculturists of established national reputation, the Chairman of the Committee of Management of the British Sugar Beet Growers' Society being Sir Beville Stanier, Bt., M.P. The Committee includes such members as Lord Selborne, Lord Bledisloe and the Hon. Edward G. Strutt.

It is perhaps necessary to explain for the benefit of those who do not live in a district where the system is practised that the word "stetch" is the term for **The Fowler Self-Lift Stetch Plough.** a narrow strip of ploughed land separated by an open or dead furrow from the strip on either side. In the stetch the furrows all turn to the centre, half the furrows being from the right and half from the left. It will be clear that by continuing this process the open or dead furrows separating the stetches will be approximately double the width of an ordinary furrow. This method of ploughing is commonly practised on heavy land in the Eastern Counties for the purpose of carrying off surface water from such crops as winter wheat, oats and beans. In many cases stetches are made the same width as the corn drill and cultivator so that the horses can walk in the open furrow and obviate any treading or puddling of the seed bed.

Stetches vary in width in different parts of the country, but in Essex the standard width is 6 ft., excluding the open furrow, which is about 18 in. wide. Ploughing such narrow strips by

steam tackle—using a balance plough and doing half a stetch at a time—or by horses is a laborious operation, and a new plough has been specially designed to plough by means of steam tackle stetches of a width of about 7 ft. 6 in. in one operation.

It may be stated that Mr. Edward Robinson, of Southminster, Essex, was the originator of this plough. He first of all constructed a working model on a cultivator frame, and this experimental implement did a good deal of useful work. The new type of plough was brought to the notice of the Food Production Department, and the idea appeared to be so promising that it was decided to make arrangements with Messrs. John Fowler & Co., Leeds, for an experimental plough to be built on the lines suggested by Mr. Robinson, the cost being borne by the Department. Some improvements were introduced at the suggestion of the Department and of Messrs. Fowler & Co., and eventually an experimental plough was constructed. The implement was first tried under actual working conditions in Essex in October last, and proved highly satisfactory. Mr. Robinson at once agreed to purchase the plough and ordered another one of the same type from the makers. At the trial, land was ploughed at the rate of about $2\frac{1}{2}$ acres per hour, and as the implement recently ploughed 70 acres in five short working days it appears to be maintaining an excellent record under working conditions.

Description of the Plough. — The plough is constructed to cut eight 9-in. furrows, and is capable of ploughing to a depth of 6 in. ; it is supplied with skives, mould-boards, steel top and bottom frames, turning-lever, lifting-gear, and self-acting raising-gear.

The construction and work of the plough are shown by the three photographs reproduced.

The plough is of the class used for cable traction, and is turned round for the return bout by the pull of the engine cables, which are attached to the triangular turning-lever carried by the implement ; each cable becomes alternately the hauling rope and the slack rope.

The turning and lifting are done by the pull of the cables, through a lever, a lifting chain and segment on the axle. The top frame is carried on a main axle, two hind wheels, and a front or steering wheel. The plough is fitted with steerage gear and self-lifting gear, as well as automatic cushion apparatus for damping the fall of the underframe.

The underframe consists of two complete and independent frames, one carrying right-hand and the other left-hand plough

bodies, which are separately adjustable vertically: and each complete frame with its plough bodies is also vertically adjustable independently of the other by means of a wheel at the front end, and two adjusting screws and blocks at the hind end. The plough bodies are carried on standards, and comprise shares, sled and mould-board, which may be of various types to suit the particular land on which the plough is expected to work.

In conjunction with the adjusting screws and blocks at the hind end, vertical guides are provided to prevent lateral movement of either underframe. The front end of each underframe is provided with lateral adjustment for draft. The underframes are raised and lowered by means of a four-chain lifting-gear so arranged that each underframe is lifted at three points.

The accurate turning of the plough at the headlands is ensured by automatic pawl catch gear, consisting of a circular rack, fitted to each of the hind wheels, automatically preventing the wheel on which the implement pivots when turning from revolving in a backward direction. The pawl catch is arranged in combination with the lifting-gear, so that when the underframes are in work the catch is held out of action, but when the underframes are raised out of work, the catch automatically engages itself with the toothed circular rack and prevents backward movement of the pivot wheel.

The plough as described above is suitable for working on land where drainage furrows already exist, and will leave new drainage furrows midway between the old ones, at a distance apart equal to the width of the land ploughed at each bout, as shown in the accompanying sketch.

For land where drainage furrows do not exist, a central plough body, with double mould-board, will be provided, suspended between the twin underframes, the object being to open out a central furrow so that the plough can work as above described and plough the fields in "lands" similarly to the method adopted with ordinary horse ploughs.

The right hand underframe which is a little in front of the other turns the first furrow into one half of the open furrow, where one exists—which is always the case when the land has been ploughed in "stetches"—and the first plough on the left-hand frame turns a furrow into the other half of the open furrow. If no open furrow exists, the central plough opens up one. The last plough on each frame leaves half an open furrow on each side of the land ploughed, and when the implement is turned round at the headland and commences

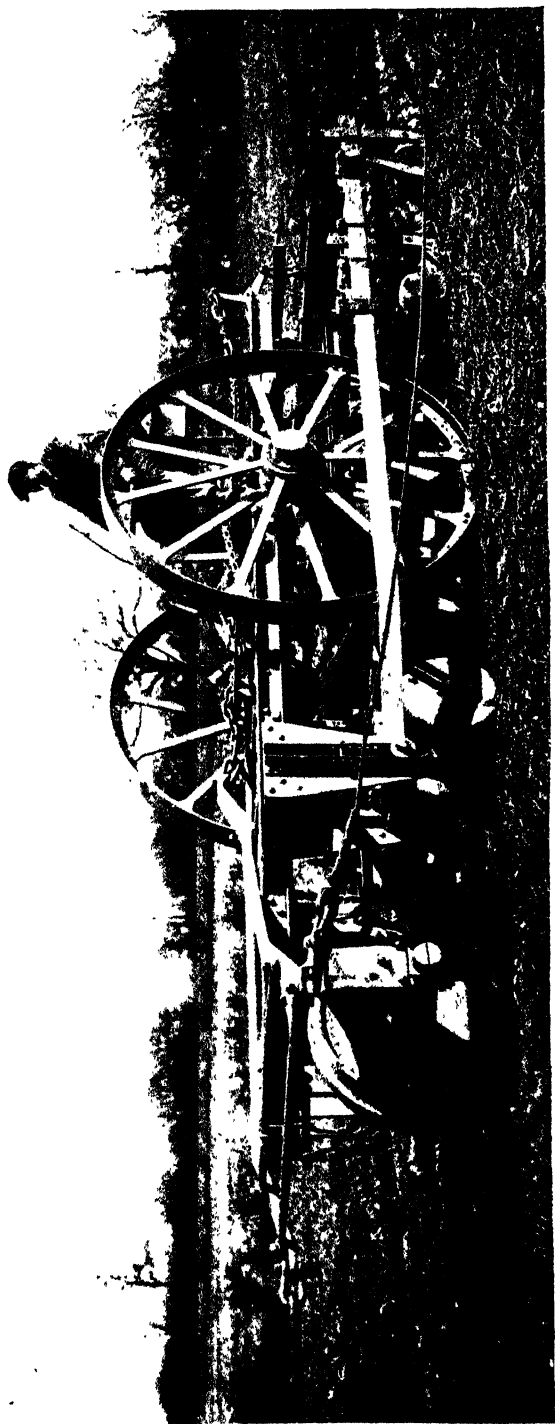


FIG. 1.—Front view of Plough.



FIG. 2.—Side view of Plough.



FIG. 3.—Showing Plough in operation.

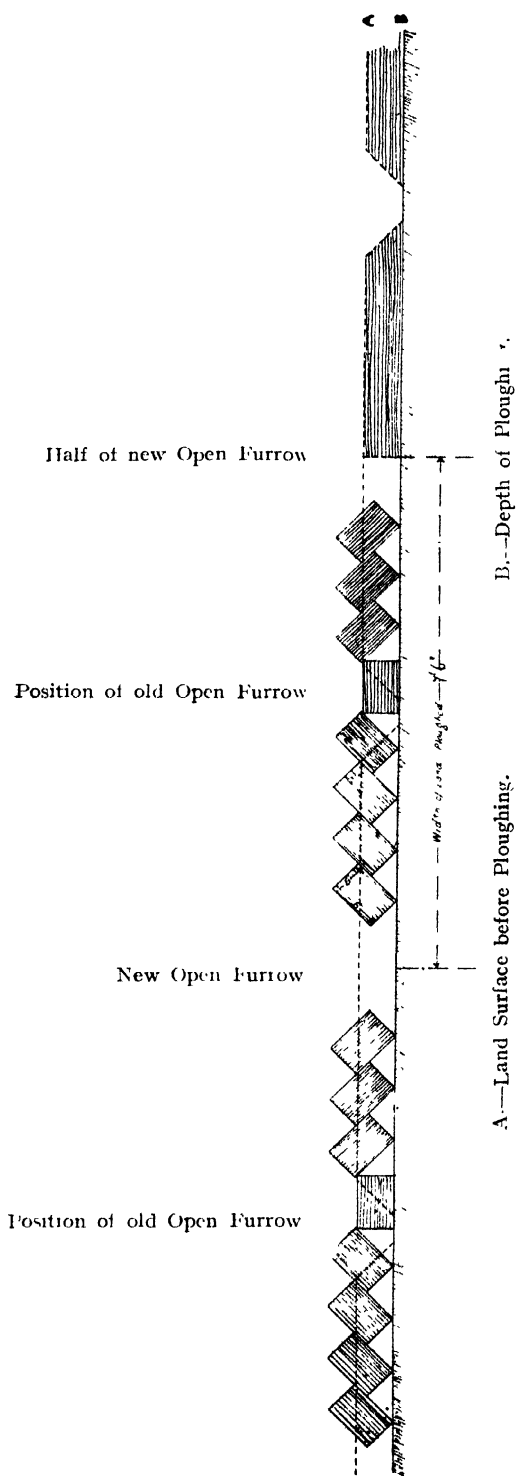


FIG. 4.—Diagram showing Method of Stetch ploughing.

the next bout, the last plough on the frame on the inside of the turn completes the open furrow by turning a furrow away from the land already ploughed.

It may be mentioned, in conclusion, that this plough can only be used for ploughing stetches of one standard width, and that if wider stetches are required to be ploughed by this process, a new model of the plough would have to be built for the purpose.

THE Report of this Committee, just issued (Cmd. 483), is the fourth and final Report submitted. The first and second Interim Reports (issued in June and November, 1917*) dealt almost entirely with questions of immediate urgency, and were chiefly devoted to the problems of keeping up the milk supply and for providing for equitable distribution in the winter of 1917. In the third Interim Report (November, 1918†) attention was given to problems which, though not mainly arising through war conditions, had nevertheless been disclosed and emphasised during the War. The present Report deals chiefly with matters affecting the milk industry and its development in the future.

I.—Present State of the Milk Supply.—(a) *Production.*—The Committee submit figures which show that although there has been a slight increase in the number of cows and heifers in milk since 1912, yet the statistics available for the United Kingdom suggest that the production of milk, after rising from 1,895,000,000 gal. (1909-13 average) to 1,910,000,000 gal. in 1914, has since steadily decreased to 1,505,000,000 gal. in 1918.

This decreased production is ascribed to—

- (a) Scarcity of the proper feeding stuffs.
- (b) Deterioration in the quality of cakes and meals.
- (c) Lessened efficiency of milkers.

(b) *Consumption.*—The Committee record their opinion that the average consumption of milk in the United Kingdom is much lower than is desirable in the national interest. They emphasise the importance of the growth-promoting substances (vitamines) which exist in common to milk and butter, and the great value of these vitamins, especially to young children. The present daily average consumption per person for Great Britain is estimated at 0.25 pt. of liquid milk, varying from 0.10 pt. in Inverness-shire to 0.31 pt. in London. This average consumption

* See this *Journal*, January, 1918, p. 1133, and July, 1918, p. 452.

† " " " " 1919, pp. 1206-1214.

is less than half the normal average consumption of the City of New York. In many industrial centres there are known to be whole streets where no fresh milk is taken. The increase in the production of milk has not kept pace with the increase in the population, the increases since 1891 being, respectively, 40 per cent. and 60 per cent., and this has led to a vast increase in imported dairy produce, especially condensed and dried milk. Dairy farming methods have not kept pace with the developments brought about on the Continent. This is ascribed to (a) the agricultural depression of the 'nineties of last century; (b) the slow development of co-operation amongst farmers; (c) the defective system of agricultural and dairying education; and (d) the almost total neglect of research in dairying subjects.

The Committee, while fully realising the essential difference in national temperament between the population of the United Kingdom and the population of continental countries, are convinced that the dairying industry would be greatly benefited by the adoption, with necessary modifications, of methods which have given excellent results in other countries, and recommendations are made accordingly.

II.—Relation between Price and Consumption.—During the War the increased cost of milk has tended to decrease consumption. When the price of feeding stuffs rose the normal difference between winter and summer costs of production was accentuated. In order to safeguard the supply of winter milk a much greater increase in price was necessary for that period than for the summer, and this variation in price has resulted in a greater variation in consumption than was formerly the case. An unduly high price for milk is prejudicial to the future of the dairying industry, for it not only reduces consumption but makes it well-nigh impossible to compete with the foreigner in the manufacture of dairy products.

The Committee believe that it would be in the ultimate interest of the consumer and would assist in an adequate supply of winter milk if it became a recognised practice to charge a higher price during the winter months, although this would probably lead to a variation in consumption.

In this connection the following table of the monthly variation in percentages of the total annual production, according to the daily average during the years 1917–18, is of interest:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.
5·9	6·0	6·9	8·1	10·8	11·8	10·3	9·8
Sept.	Oct.	Nov.	Dec.				
9·1	8·3	7·1	5·9 = 100.				

III.—Necessity for Lowering the Cost of the Production of Milk.—

The Committee submit surprising figures showing the variation in the cost of production. Returns from 43 farms show a variation in net costs for the winter 1916-17 of 10*d.* per gal. On six farms the cost was less than 10*d.* per gal. ; on six farms 20*d.* per gal. It is pointed out that during the period of controlled prices the economical production of milk is not effectively stimulated for the reason that cheaper production will tend to lower maximum prices.

IV.—Present State of Milk Supply—Quality and Cleanliness.—

Not only is the amount of milk consumed in Great Britain much lower than desirable, but the quality as regards cleanliness is grievously defective. In the United States of America no raw milk with more than 30,000 bacteria per c.c. may be sold for human consumption. In 1916-17 Professor Délépine, investigating samples of milk delivered to Manchester hospitals, found that out of 30 samples 64 per cent. contained over 1,000,000 bacteria per c.c. The special Sub-Committee on the handling of milk makes many recommendations for effecting a much needed improvement, tracing the milk from the moment it is drawn from the udder of the cow until it reaches the consumer. The point that great improvement is possible without large expenditure on buildings and equipment is emphasised. The present system, or lack of system, in handling milk on railways is condemned, and suggestions are made as to how improvements may be effected.

V.—Policy of the Future.—Reference has been made in preceding paragraphs to some unsatisfactory conditions of the milk industry and to the necessity of increasing consumption and production. The Committee are aware that this cannot be accomplished hurriedly without the sympathy and co-operation of both producer and consumer. The aims of an enlightened milk policy should be :—

- (a) To bring about the utmost economy in production.
- (b) To improve the hygienic quality of milk.
- (c) To increase the supply to meet increased consumption which should follow improved quality.
- (d) To prevent the exploitation of the producer or consumer by any trust or combination.

VI.—Steps to be taken to Reduce the Cost of Production.—The Committee consider that the cost of production can be lessened :—

- (1) By reorganising the system of herd management in order to (a) reduce the loss when high-priced cows are sold for slaughter ;

(b) lengthen the milking period ; (c) obtain better distribution of the dates of calving ; and (d) reduce as far as possible dependence on purchased foods.

(2) By improving the average yield per cow.

(3) By more economical and methodical feeding.

(4) By the introduction of labour-aiding machinery and gradual rearrangement of farm buildings.

(5) By more business-like methods of book-keeping.

(6) By greater cleanliness in production and handling of milk, thus reducing losses due to souring.

(7) By the extension of co-operative methods in the purchase of feeding stuffs and manures, particularly on the part of small farmers.

(8) By the State-provision of veterinary help so as to reduce losses due to contagious abortion, tuberculosis, etc.

(9) By better organisation of collection and transport of milk.

These points are dealt with in detail, and instances are quoted of the saving effected on specific farms, thus :—

On farm A the average number of cows in milk was 53, the total cost of food was £794 15s., and the total yield 46,221 gal. of milk.

On farm B the average number of cows in milk was 51, the total cost of food was £774 17s. 3d., and the total yield 36,033 gal.

The cost of food per gal. on farm A works out at 5·12d., on farm B 7·4d.

The Committee estimate that if the average yield per cow in the United Kingdom could be increased by one-tenth of a gal. per day, present prices would automatically fall about 2d. per gal.

Higher yields may also be obtained in the summer months by judicious manuring of pastures.

The question of tuberculosis is fully dealt with, and specific recommendations as to the future use of the tuberculin test are made.

VII.—Improvement in Hygienic Quality.—The Committee consider that the principle of grading milk is sound, as it offers to farmers generally an inducement to improve the quality of their milk, and tends in a short time to eliminate milk of a high bacterial content.

When the grading of milk was first commenced in New York, in January, 1912, 40 per cent. of the city's supplies fell within the definition of the lowest grade, Grade C. In July, 1914, the amount of Grade C milk sold in the city was negligible, one-seventh being Grade A, and six-sevenths Grade B. The steps taken to raise from Grade C to Grade B were within the

capacity of all producers and dealers. By attention to those details which have proved to be of the greatest importance it has been clearly demonstrated that it is possible to produce milk with a very low bacterial content without the aid of model buildings and expensive equipment.

VIII.—Increased Production of Milk in Great Britain.—The vital question of labour has been investigated by a special Sub-Committee, and much useful information is included in the Report attached to that of the main Committee. This Report includes details of a number of systems of co-partnership which are operating successfully in various parts of the country. The Committee make the following recommendations :—

(1) The number of dairy stock in the country should be increased as much as possible.

(2) Arable dairy farming should be encouraged and extended. In this connection they welcome the establishment of the Arable Dairy Farming Demonstration Farms by the Board of Agriculture.

(3) Facilities should be given for the importation of Holstein cattle, and the question of the importation of other dairy breeds should be inquired into.

(4) A careful examination should be made of the relative economy of the different home breeds under varying influences of soil and climate.

Several appendices are attached to the Report..

THE following estimate, prepared by Mr. Wilfred Buckley, Director of Milk Supplies, Ministry of Food, of the cost of production of one gal. of milk on the average farm in Great Britain during the period 1st December, 1919—30th April, 1920, omitting (a) interest on capital, (b) managerial expenses, (c) profit, is extracted from the issue of the *National Food Journal* for 10th December, 1919.

The figures shown in the tables are calculated on the following premises :—

(i.) *Labour.*—One man can milk and attend to twelve cows in milk and the proportion of dry cows that are in the herd. To carry out this work, seventy hours weekly are required. (In case one man does not work this number of hours the services of another person are required to complete the work.)

Minimum wage (Derbyshire, etc.), 37s. 6d. for 48 hours plus 1s. 0½d. for 22 hours' overtime equals 60s. 5d. or 8·63 pence per day per cow.

NOTE.—The minimum wage is higher in many counties than the above. A large proportion of cowmen are paid in excess of the minimum wage.

(ii.) *Daily Maintenance Ration* per cow whether dry or in milk :—12 lb. hay at 140s. per ton, 9·00 pence ; 8 lb. straw at 50s. per ton, 2·16 pence ; 56 lb. roots at 27s. per ton, 8·10 pence. Total, 19·26 pence.

These foods, being in the majority of cases home-grown, are calculated at the cost of production and not at market values.

(iii.) *Production Ration for Cows in Milk*.—3 lb. of cake (or its equivalent in some other form of concentrated food) for each gallon of milk at a cost of £25 per ton, less manurial value at 66s. 6d. per ton, *i.e.*, £21 13s. 6d. per ton net, equals 6·97 pence per gal.

(iv.) *Depreciation* per cow at the rate of £5 per annum equals 3·33 pence daily.

(v.) Costs of (a) proportion of rent and rates, (b) repairs, (c) depreciation on machinery, (d) delivery, are off-set by the value of calves born.

On the above data, the cost of production in respect of cows in milk varies in proportion to the yield per cow, as under :—

TABLE A.

YIELD OF MILK PER COW PER DAY.

Items.	2 gal.	1½ gal.	1½ gal.	1½ gal.	1 gal.
Labour	8·63	8·63	8·63	8·63	8·63
Maintenance ration ..	19·26	19·26	19·26	19·26	19·26
Production ration ..	13·94	12·20	10·45	8·71	6·97
Depreciation ..	3·33	3·33	3·33	3·33	3·33
Cost per cow daily ..	45·16	43·42	41·67	39·93	38·19
Cost per gal. of milk in pence	22·58	24·81	27·78	31·94	38·19

In addition to the cost of maintaining those cows that are in milk, there is the added cost of those cows that are dry. The following figures show the costs in pence that have to be added for the maintenance ration of dry cows, in proportion to the various yields per cow in milk :—

TABLE B.

Basis of Yield per Cow in Milk.	2 gal.	1½ gal.	1½ gal.	1½ gal.	1 gal.
In case there is one dry cow to two in milk	4·82	5·50	6·42	7·70	9·63
In case there is one dry cow to three in milk	3·21	3·69	4·28	5·14	6·42

In Mr. Buckley's opinion the average cow in milk from 1st December to 30th April will yield, approximately, $1\frac{1}{2}$ gal., and there will be in the average herd one cow dry to two cows in milk. He therefore estimates the average cost per gal. to be for each cow in milk 27·78 pence per gal., for proportion of dry cow 6·42 pence per gal.: total cost per gal. 34·20 pence.

Is it too late to use Lime now?—A correspondent writes to ask whether it is too late to use lime in the following circumstances:

He has applied 16 tons of farmyard manure
Notes on Manures and intends to sow white spring oats ;
for February: can he top-dress with lime now, and, if so,
From the Rothamsted how close to drilling time will this be
Experimental Station. permissible ?

The reply is that lime is hardly necessary for spring oats, as this crop needs it much less than certain other crops. The most effective place in the rotation to apply lime is just before clover. It can also be used with considerable advantage on barley and on swedes, but other arable crops do not require it to so marked an extent.

The simplest case arises where the clover is sown in the barley; lime can then be applied some time before drilling the barley so that both barley and clover may benefit.

The correspondent further inquires whether lime can with advantage be given to mangolds. This crop does not respond to lime so well as swedes, but if there is any difficulty in securing a tilth lime would be distinctly useful. Otherwise lime is better reserved for the swedes and turnips.

The worst place for putting on lime in the rotation is just before the potato crop, and this should never be done where there is any fear of Scab.

Sulphate of Ammonia and Nitrate of Soda.—In reference to the statement in the December notes (this *Journal*, November, 1919) that the price of nitrate of soda compares favourably with that at which sulphate of ammonia can be obtained, a correspondent asks whether this implies that nitrate of soda is a better fertiliser than sulphate of ammonia? No such implication is meant; the two fertilisers are quite distinct, and although they are often interchangeable it is by no means always possible to use one instead of the other. Nitrate of soda is quicker acting than ammonium sulphate and, therefore, in many cases more useful. Further, it does not exhaust lime like sulphate of ammonia and can, therefore, be used on light soils deficient in this substance. On the other hand, ammonium sulphate is

considered distinctly superior for certain valuable crops such as potatoes, malting barley, etc., and it has no adverse effect on the tilth of heavy soils where nitrate of soda may be harmful. On the basis of chemical composition, 76 lb. sulphate of ammonia contains as much nitrogen as 100 lb. nitrate of soda, but the nitrogen in sulphate of ammonia is not so effective lb. for lb. as that in nitrate of soda; in fact, 1 lb. nitrogen in nitrate of soda is as effective as 1.035 lb. nitrogen in sulphate of ammonia; and on an average of all crops 100 lb. of ordinary nitrate of soda are about as effective as 80.3 lb. of sulphate of ammonia. These figures, however, take no account of the special uses of the two substances to which reference has just been made.

Price of Mixed Fertilisers.—A correspondent, interested in the fertiliser trade, has suggested that the comparison made in the December notes between the home-made and the purchased mixed fertilisers is unfair, for the following reasons:—

1. That the receipt given for the home-made fertiliser would not as a matter of fact contain the same constituents as the proprietary article in question; he offers two receipts which would cost, respectively, £14 4s. 3d. and £14 5s. 5d. instead of £13, the cost of the home-made mixture. The proprietary article was offered at £19.

The correspondent claims that the manufacturer in making the mixture has to pay double carriage, and in all probability has to use a considerable number of new bags, items which would account for some of the difference between the £14 5s. and the £19.

The composition of the various mixtures is as follows:—

Manure.	Proprietary Article quoted.	Home-made Mixture suggested in Dec. Notes.	The Correspondent's Mixtures.	
			A.	B.
Quantity	20 cwt.	20.75 cwt.	22.5 cwt.	20 cwt.
Cost	£19	£13*	£14 4s. 3d.	£14 5s. 5d.
Ammonia	cwt. 1.4	cwt. 1.41	cwt. 1.59	cwt. 1.59
Soluble phosphate	4.0	3.97	4.05	4.07
Insoluble phosphate	0.5	—	0.29	0.3
Sulphate of potash	1.6	1.58	1.8	1.8

* The mixture would cost £12 10s. 7d. per ton, but 80½ cwt. would be necessary to supply the same amount of plant food as is contained in 1 ton of the proprietary article, and the cost of 80½ cwt. is £13.

It will be observed that the home-made mixture suggested in the December notes approximates closely to the proprietary

article in composition, while the correspondent's mixtures are both better. With regard to the claim that the manufacturer has to pay double carriage and use new bags, it should be pointed out that this would not apply to the larger fertiliser manufacturers, but only to some of the smaller mixers, and that against these items would have to be set the special discount allowed to manure mixers but not to individual farmers. In view of these considerations it can hardly be claimed that a farmer would be justified in paying so high a price for the material in question.

Manuring of Seeds Hay.—In the west and north of England and in Scotland the manuring of the seeds hay is well understood and is a common practice; in the Eastern Counties, however, little if any manuring is done. The difference arises from the circumstance that the seeds hay in the Eastern Counties is generally pure clover intended for one year only, whilst elsewhere it is a mixture containing grasses intended to remain down two or more years. If the land is already in good heart, is sufficiently well limed, and has recently received a good dressing of farmyard manure, the clover will probably want nothing more. For some time, now, however, farmyard manure has been scarce, and good dressings have been the exception rather than the rule. In these circumstances the clover ley may well receive more attention than is usually given to it.

First and foremost it is essential that the land should be well supplied with lime, as any acidity is fatal to the crop.

It is also essential that there should be a sufficient supply of phosphates, and if neither basic slag nor superphosphate has been applied recently to the land, one or other should be given to the clover crop. Farmers in the Eastern Counties may well pay serious attention to the experiments made at Saxmundham on the effect of phosphates on the clover crop. Not only was the yield of clover increased but the succeeding wheat crop benefited considerably also. The unmanured clover gave a yield of 39 cwt. of hay per acre in two cuts in 1914. This yield was raised to 51 and 53 cwt. per acre when 5 and 10 cwt. of slag, respectively, were applied. Four cwt. of superphosphate per acre raised the yield to 56 cwt., which shows a very substantial increase on the unmanured crop. Further, the additional nitrogen fixed by the larger clover crop greatly benefited the wheat crop. After the unmanured clover the wheat crop (also unmanured) gave less than 20 bush. to the acre; after the slagged clover the yields on the two plots were 26½ and 31½ bush., and after the superphosphate 25½ bush., per acre. The succeeding

swede crop benefited from the superphosphate and also the following barley crop where 10 cwt. of slag had been given. The full results were as follows :—

*Yields per Acre produced by One Dressing of Fertiliser.
Saxmundham.*

Plot.	Manurial Treatment, Winter, 1913-14.	1914 Clover Hay. 2 cwt.	1915 Wheat. No Manure to any Plot.		1916 Swedes. 15 tons F.Y.M. applied to all Plots.	1917 Barley. No Manure to any Plot.	
			Corn.	Straw.		Corn.	Straw.
1	10 cwt. slag, 30 per cent...	Cwt.	Bush.	Cwt.	Tons. cwt.	Bush.	Cwt.
2	5 cwt. slag	53	31.7	34.3	8 5	20.0	18.2
3	5 cwt. slag, 1 cwt. muriate of potash	51	26.7	34.3	8 10	12.1	21.4
4	None	53	27.9	35.3	8 7½	13.5	21.8
5	4 cwt. 30 per cent. super. .	39	19.7	36.4	8 2½	14.3	16.4
6	4 cwt. super., 1 cwt. muriate of potash	56	25.4	37.1	9 10	13.5	18.2
		60	23.5	38.2	10 10	12.1	18.5

Lucerne also benefited considerably by the application of phosphates. The addition of farmyard manure as well as superphosphate caused a still further increase which might, perhaps, have been even greater had more phosphate been applied. Lime had a useful though less marked effect. The results are :—

Lucerne Experiment, Saxmundham. Commenced 1910.

Plot	Plots dressed in 1910 and 1913.	Lucerne Hay, Cwt. per Acre.						Total Crop 6 Years.	Pre- War total Cost of Manure.	Total Increase due to Manure
		1911 3 cut- tings.	1912 3 cut- tings.	1913 2 cut- tings.	1914 2 cut- tings.	1915 2 cut- tings.	1916 2 cut- tings.			
1	No manure ..	20	81.5	54.8	52.3	58	55.5	Cwt. 322	s. d.	Cwt. —
2	1 ton ground lime ..	20.5	86.5	60.3	56.3	59.5	67.3	350	50 0	28
3	2 cwt. super., 6 tons farmyard manure	20.2	95	72.1	64.5	71.0	65.1	388	72 0	66
4	2 cwt. super. ..	21.5	91	68.0	58.7	63.0	78.3	381	12 0	59
5	5 cwt. super. ..	21	92.5	66.4	58.7	69.5	76.7	385	30 0	63
6	2 cwt. super., 1 cwt. muriate of potash	19	85	70.7	55.2	68.0	62.1	360	32 0	38

*Saxmundham Report, 1915-18. Ipswich, 1919.

In view of these interesting results it is important that more trials should be made in order to ascertain how far manuring the seeds hay is likely to be helpful.

Scarcity of Farmyard Manure.—It is a common complaint of many farmers that they have less farmyard manure than they would like, and see no way to increase their supplies. On some farms, probably on many, fewer animals are being fattened in yards than is usual at the present season of the year. The farmer who finds himself in this position may adopt one of several courses to help over the difficulty.

1. The greatest care must be taken to avoid waste of such farmyard manure as is available ; methods have been discussed in former notes by which this can be done.

2. A compost may be made of broken straw, hedge clearings and other suitable materials. Such a compost is not as good as farmyard manure, but it has the merit of supplying organic matter and, therefore, may prove distinctly valuable.

3. In place of a one-year clover ley a mixture of clover and grass can be substituted and left down for two or three years. Considerable amounts of humus are thus formed, which, on ploughing in, exert a beneficial effect on the soil.

Rock Phosphates.—A correspondent has asked whether and if so under what conditions rock phosphates can be used in place of basic slag and superphosphate. This question was raised many years ago by the late Dr. Jamieson, but it soon ceased to be of interest because the supplies of superphosphate and basic slag were more than adequate for British consumption ; indeed, considerable quantities were exported. In present circumstances, however, this is no longer the case, and there is now no excess of fertilisers. The question, therefore, arises, whether rock phosphates can be used direct or whether conversion into superphosphate is really necessary.

Experimental evidence has been obtained showing that rock phosphates are of value in the north of England and also in Scotland and Wales ; they have not proved successful, however, at Saxmundham in Suffolk. The following table shows the average of some of the field experiments carried out in Scotland :—

Field Experiments with Phosphates upon Turnips, 1911-14.
(Average of 66 Experiments.)

Plot.	Tons cut.
1. No artificial manure	13 17
<i>Sulphate of ammonia, potash manure salts, and—</i>	
2. superphosphate	20 12
3. basic slag	20 0
4. ground mineral phosphate	19 10
5. steamed bone flour	20 7
6. bone meal	19 11
7. dissolved bones	20 3
8. mixture of superphosphate and basic slag ..	20 15
9. mixture of superphosphate and ground mineral phosphate	20 8
10. mixture of superphosphate and steamed bone flour	20 15
11. mixture of superphosphate and bone meal ..	20 11

Farmyard manure was applied equally on all plots at the rate of about 12 tons per acre. Sulphate of ammonia and 30 per cent.

potash manure salt were applied equally to plots 2 to 11 at the rate of $\frac{1}{2}$ cwt. of each per acre. An equivalent amount of phosphoric acid, approximately 50 lb. per acre, was given to each of plots 2 to 11. In plots 8 to 11 one-third of the phosphoric acid was from superphosphate, and two-thirds from the other phosphatic manures.

In these cases the mineral phosphate has proved nearly equal to slag. The difference, though only small, may, however, be real, in view of the large number of experiments involved.

At Cockle Park, Tunisian rock phosphate and Belgian rock phosphate both proved less effective than basic slag, though the difference was not very great. The fertilisers were used at the rate of 200 lb. of phosphoric acid per acre, corresponding to nearly 10 cwt. of 41 per cent. basic slag. The results of the third test carried on from 1913-15 were as follows:—

Cockle Park: 3 Years' Grass Ley. Yield of Hay in Cwt. per Acre.

—	1st Year, 1913.	2nd Year, 1914.	3rd Year, 1915.	Average.
Unmanured	33 $\frac{1}{2}$	37 $\frac{1}{2}$	22	31
Basic slag	44 $\frac{1}{2}$	48 $\frac{1}{2}$	27 $\frac{1}{2}$	40
Tunisian rock phosphate	35	41 $\frac{1}{2}$	30 $\frac{1}{2}$	36
Belgian rock phosphate	41	39 $\frac{1}{2}$	29	36

These figures bring out an interesting property of the mineral phosphates—that they are less useful than superphosphate or basic slag in the early days of the plant growth. Thus they gave a lower yield than slag in the first and second years at Cockle Park; further, it was noticed in Scotland that the braird of arable crops was considerably below that obtained with superphosphate or slag. It has been suggested that the difficulty can be overcome by adding a certain proportion of superphosphate which can be used by the seedling, leaving the mineral phosphate for the older plant.

Experiments in North Wales also indicate that rock phosphate is distinctly effective. At six centres the yields of swedes were:—

	Tons	cwt.
No phosphate	12	18 $\frac{1}{2}$
*Gafsa phosphate (333 lb.)	21	13 $\frac{1}{2}$
*Superphosphate (539 lb.)	22	10

* Both contained 200 lb. of total phosphate.

Broadly speaking, these different results indicate that finely-ground mineral phosphates are worth trial in England west of the line from Durham to Southampton, but that no farmer should rely upon them until a proper comparison has first been made with basic slag and superphosphate. There are many cases in which superphosphate proves invaluable in

promoting early root development, quite apart from its effect on the adult plant ; there is no evidence that mineral phosphates can act in this way. Further, there are many cases in which basic slag has had remarkable effects in regenerating poor pastures ; here, also, there is no evidence that mineral phosphates would act equally well. The average results show that mineral phosphates can produce useful effects on the adult plant under suitable conditions, but not enough is known about these conditions to justify advice to individual farmers as to whether mineral phosphates would be useful to them or not.

It is just a year since it was decided to suspend the issue of these notes. All that time the shortage of all kinds of feeding stuffs was so acute, and the control so stringent, that owners of live stock were constrained to buy what they could get, and advice was of little value. The general situation is now somewhat easier and supplies are improving, so that advice as to the purchase and use of feeding stuffs may once more be of some practical use. These notes will therefore in future appear in the *Journal* every month, and the present article must be considered as introductory.

It may be useful to draw attention to some of the more striking lessons of the War and to point out certain facts about the trend of supplies.

Beef Production.—To those who are engaged in the production of winter beef, perhaps the most surprising fact which has emerged from the exigencies of the War is the small amount of concentrated food which is really necessary for full-grown cattle fattening on roots and straw. This fact has been thoroughly established in a series of feeding trials carried out during the War and reported in this *Journal** under the title "War-time Beef Production." Since then the trials have been repeated at the Norfolk Agricultural Station and on the writer's own farm with entirely similar results. In these trials full-grown bullocks on a ration of 1 cwt. to 1½ cwt. of roots, and 10 lb. to 14 lb. of straw or straw and hay, supplemented by only 1½ lb. per head per day of common cotton cake, were ready for the butcher in from 16 to 20 weeks, by which time more than half of them were supergraded. Several typical animals on slaughter yielded over 56 per cent. of dressed carcass. Further,

* Issue for September, 1918, p. 623.

the financial result of such feeding was more satisfactory than that of comparative trials in which a full cake ration was used. This financial result has been further confirmed by several of the more progressive farmers who saw the trials at the Norfolk Agricultural Station and have for the last two years successfully adopted a ration of roots and straw *ad libitum*, and either 1 lb. per day of cake or no cake at all. There is no room for doubt that when cake is dear, and fat bullocks sell for little more per live weight than they cost as stores, the use of an extremely low cake ration is the only chance of avoiding a heavy loss in the production of winter beef. It may be true that the manure made by cattle on such a ration is relatively poorer in nitrogen than where a full cake ration is used, but recent work at Rothamsted on the bacteriology of farmyard manure throws some doubt even on this contention. Even if it is true, the deficiency of nitrogen can be corrected by supplementing the manuring of the crop to which the dung is applied by a top-dressing of 1 cwt. per acre of sulphate of ammonia. This would cost about 20s. for each animal, which is far less than the cost of 7 lb. of cake per day for 16 weeks, which would be about £7. For the low cake ration fed with a large ration of roots, common cotton cake is the most suitable, for not only does it supply the protein necessary to balance the ration, but its astringent properties tend to prevent the scouring which may result from the consumption of so much succulent food. Its use is also indicated by the fact that the prospect of increased supplies has caused the price to fall to some extent below the maximum of £19 10s. per ton. Some samples have been sold as low as £17 10s. per ton ex-mill, or 4s. 9d. per digestible food unit. Uncorticated or semi-decorticated ground nut cake is also suitable for cattle fattening on roots and straw. It contains more protein than cotton cake but is not so astringent. It is, however, cheaper. At £21 per ton ex-mill it comes to almost exactly 4s. per digestible food unit.

Milk Production.—Although it is both successful and economical to reduce the cake ration for beef production, this is by no means the case in feeding for milk production, since milk contains so much protein that a high ration of cake or some other nitrogenous concentrated food is absolutely necessary for cows on roots and straw or hay in the winter. A 9-cwt. cow requires $\frac{3}{4}$ lb. of protein and from 6 lb. to 7 lb. of starch-equivalent for maintenance. In addition to this she should get $\frac{1}{2}$ lb. of digestible protein and $2\frac{1}{2}$ lb. of starch-equivalent for each gallon of milk she gives. A maintenance ration can be provided by $\frac{3}{4}$ cwt. of roots and a stone of hay or straw.

If the latter, about 1 lb. of cake should be given to ensure the requisite ration of protein, since both roots and straw are deficient in this constituent. To this maintenance ration must be added about 3 lb. of concentrated food for each gallon of milk. It is wiser to give a mixture of several concentrated foods rather than any one such food alone. Feeding stuffs suitable for milch cows are :—

	s.	d.	
Bran, at £12 10s. per ton ex-mill ..	=	3 3	per food unit.
Dried Ale Grains, at £15 per ton ex-wharf ..	=	3 0	„
Palm Kernel Cake, at £13 per ton ex-mill ..	=	2 9	„
Decorticated Ground Nut Cake, at £20 per ton ex-mill	=	3 10	„
Linseed Cake, at £25 per ton ex-mill ..	=	4 2	„

It is necessary to point out that in order to make a fair comparison between the costs of these feeding stuffs possible, the ex-mill or ex-wharf prices ruling in London about 8th January have been quoted. Prices might vary slightly in other parts of the country. The prices do not include the cost of bags. A farmer purchasing through a dealer would also have to pay over and above these prices any transport charges incurred, and in some cases a sum to represent the dealer's profit. Purchases of small quantities from local dealers would, of course, be at higher rates.

Palm kernel cake is much the cheapest of these feeding stuffs and is particularly suitable for milch cows. It should form half the mixture; the balance may be bran and decorticated ground nut cake. The writer's cows have given excellent results on this mixture for the last two months.

Pig Feeding.—The troubles of the pig keeper as regards food are by no means over. Pigs are, or were, fed for the most part on cereals or cereal products, and there were annually available of these feeding stuffs from 1909 to 1913 an average of about 1,400,000 tons of millers' offals, 2,000,000 tons of maize (of which a small proportion was used for industrial purposes), 1,000,000 tons of barley and 300,000 tons of brewers' grains, together with considerable quantities of rice meal, etc. The present production and importation of millers' offals appear to be at the rate of 1,500,000 tons, and of maize 750,000 tons per annum. The quantity of barley and its products available for feeding purposes during the present year is likely to be at least equal to that consumed before the War. There is, therefore, a reduction of 20 to 25 per cent. in the supply of cereals and cereal products suitable for pigs. As a set-off against this deficit there is a similar reduction in the total number of pigs in the United Kingdom, and there is no doubt that during

the War pig keepers learned to use many foods which they had neglected before, *e.g.*, extracted palm kernel meal, roots and refuse materials of all kinds. The practice of keeping pigs in the open also increased during the War, and is to be commended.

Supplies of Feeding Stuff.—The cereal supply has already been referred to as regards millers' offals, maize and barley. The supply of home-grown oats is about 3 million qr. greater than the average supply available annually from 1909 to 1913, for though the yield in 1919 was poor a considerably larger average had been sown. There seems no reason to anticipate serious difficulty in importing any additional quantities that may be required.

The supplies of cakes of all kinds seem to show signs of improving, and in many cases the prices on the market are below the maximum. The chief difficulty is in distribution.

THE necessity for very careful grading and packing of fruit, particularly apples, is continually being emphasised by all sections of the fruit trade, including growers. Notwithstanding the fact that growers are fully aware of this need, and although propaganda work continues unceasingly year after year, little progress is made.

**Apple Packing at
the Eastern Counties
Commercial Fruit
Show.**

One of the best means of impressing backward growers of the necessity for good packing is through commercial fruit shows, such as those held recently at Maidstone, Cambridge, Cheltenham, Gloucester and Pershore. These exhibitions of apples packed on the best commercial lines enable growers to compare their fruit, and the way it is packed, with their neighbour's. Competitions of this description are invaluable as a means of introducing and emphasising improved methods, and of inducing their permanent adoption.

It is regrettable that few growers are able to attend regularly the large distributing markets such as London, Birmingham, Manchester, Newcastle, Glasgow, etc., and see the condition of their fruit on arrival, compare it with that of their competitors at home and abroad, and become convinced of the increased returns obtained from fruit which has been well packed and attractively marketed compared with equally good samples of fruit which are, however, bruised and badly put up. Were this possible a great improvement would almost certainly soon take place, but failing this, the Commercial Fruit Show provides the best method of convincing growers.

In order to illustrate the common faults met with in apple packing, and to suggest and urge how these may be overcome,

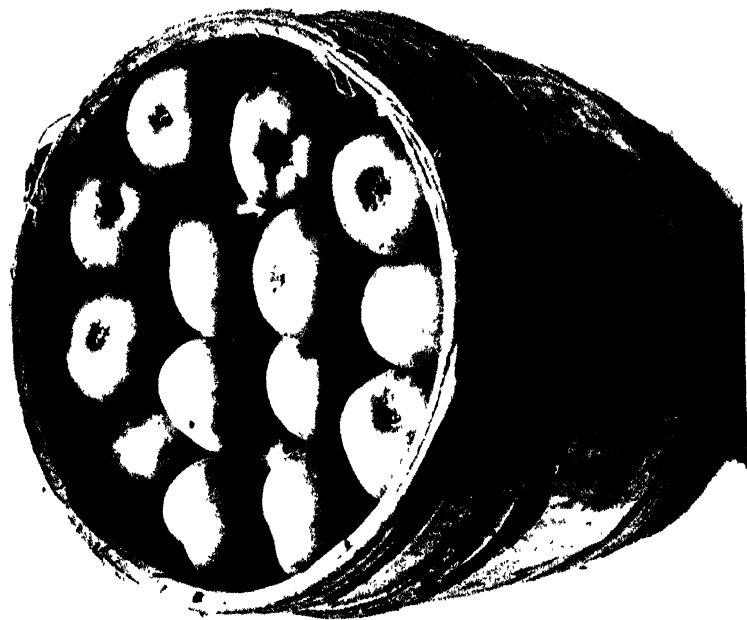


Fig. 2.

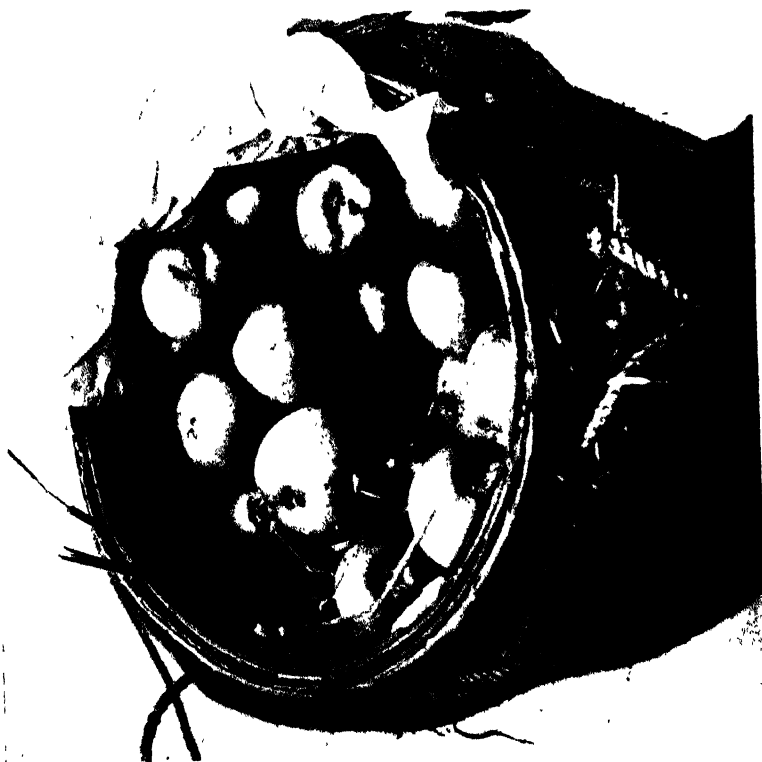
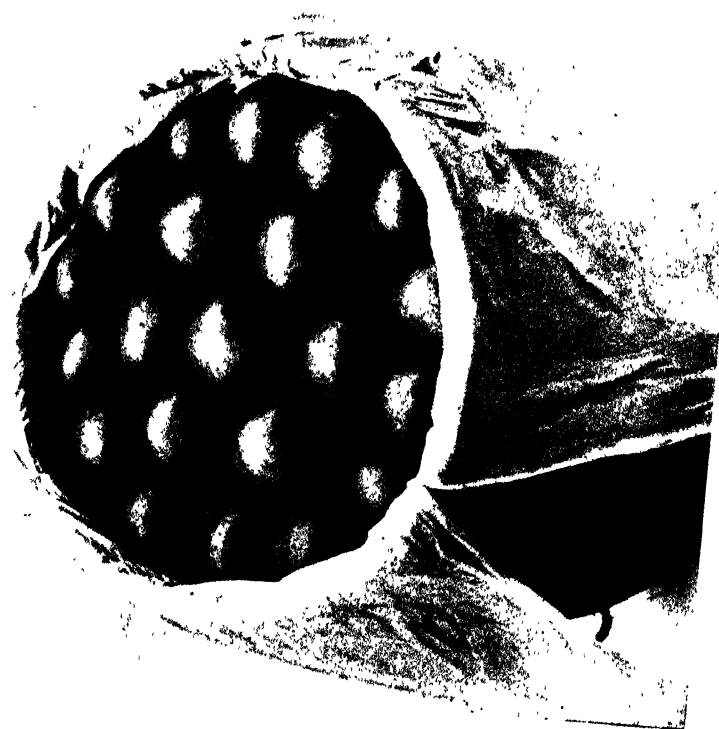
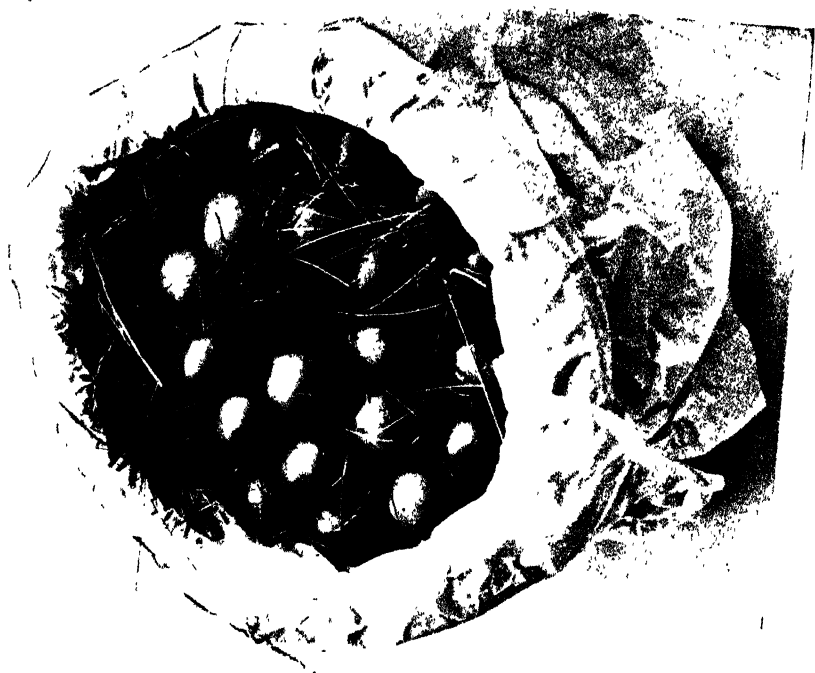


Fig 1.



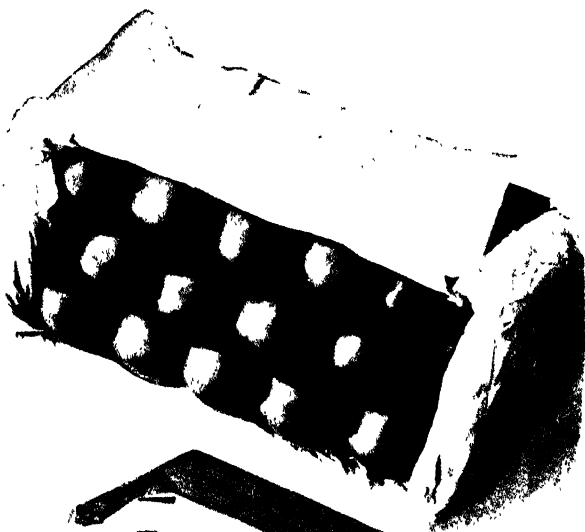


Fig 5



Fig 6.



Fig 7.

the photographs published with this note were taken at the Cambridge Commercial Fruit Show at the suggestion of the Board. The variation in the quality of the packing at this Show was astounding. These photographs do not in any way exaggerate this regrettable lack of uniformity.

No matter what package is used, there is a right and wrong method of packing, and the following essential points must be strictly adhered to if the produce is to look attractive when it arrives at the wholesale market :—

1. *HONEST GRADING*, both as to size and quality—
no "topping."
2. *FULL PACKAGES AND FIRM PACKING*.—The fruits should be packed so that each is held in position by its neighbours. Only in this way can *the package be filled* and bruising of the fruit reduced to a minimum.
3. *THE MINIMUM USE OF PACKING MATERIAL* required to prevent bruising those apples which touch the side of the package.

Not only does strict adherence to these essentials ensure the fruit arriving at the market in an attractive condition, but, equally important, an impression is soon made on the buyers and their confidence is obtained. Filling the packages completely is most important in this connection. Growers who do not attend the markets and see their produce sold never realise the importance of gaining the complete confidence of the final wholesale purchaser of their produce. They do not appraise the value to themselves of this sense of security to the purchaser in terms of pounds, shillings and pence.

The time a retail buyer is able to spend in the market purchasing his supplies is, of necessity, very limited, and if a large quantity of fruit has to be purchased extra time cannot be wasted in estimating carefully the proportion of sound and unsound, or large and small fruit in an ungraded sample. If the retail buyer must buy ungraded and badly-packed fruit he only gives a price which, from his point of view, is safe to produce a profit after allowing for waste. Such a price is always a poor one to the grower. On the other hand, fruit well packed and graded soon gets a name for the grower. The buyer knows that he can rely on the sample and can buy without undue risk, even on the consignment note. Further, competition amongst buyers is promoted and the salesman, by taking advantage of this, is able to return an enhanced price.

Attention is called to the following points brought out in the illustrations :—

Barrel Packing (Figs. 1, 2, 3).—In Fig. 1 the fruits have been poured into the barrel, which has not even been filled. The packing materials consist of a little crumpled paper and straw. (The straw is quite unnecessary up the side of a barrel; it is only required for the head and tail.) Although this particular package had only travelled a short distance to the show, much of the fruit had already been damaged by bruising. What value would such a sample have on the open market? The fruit is bruised, the package only three parts full. If the grower and his packer could hear the remarks passed by retail buyers on a sample of this description they would never pack like it again.

The barrel in Fig. 2 has a better appearance than that shown in Fig. 1 and is full. The fruits, however, are not packed tightly and are bound to bruise as they are rattled about by the rail and market porters. Besides, the appearance would have been greatly improved by an ample lining of white paper.

Fig. 3 shows a well-packed barrel. Nothing could look better. It is full. The fruits hold each other tightly together and cannot bruise. The grading is good. The apples look attractive as they are packed on their cheek and not eye up; they are shown off by means of ample white paper.

Bushel Packing. (Fig. 4).—The principles underlying packing in bushels are very similar to those for barrels, but Fig. 4 illustrates how easily a good pack can be spoilt. The hay has been used to counteract slack packing, but its use completely destroys the appearance of the sample, and down goes the market value in consequence.

Box Packing (Figs. 5, 6, 7).—Unfortunately the cost of non-returnable apple boxes at the present time restricts this system of packing to high-quality samples. Nevertheless, as an effective means of displaying the fruit, and of giving the buyer the full quantity of fruit to which he is entitled, this form of package is admirable. No doubt, when timber becomes cheaper, this package will again come to the fore.

Success in box packing depends very largely on perfect grading and tight packing—to obtain the latter the minimum of packing materials (woodwool and paper) should be used.

Fig. 5 shows a box of Lord Derby's packed properly.

Fig. 6 shows some fine Allington Pippins, but the box is only half full owing to the amount of paper which has been used. If the apples are very choice, it is sufficient for the box to be packed on exactly the same principle as Fig. 5, but with each apple wrapped in absorbent tissue paper.

Fig. 7 shows inferior packing, which is slack, and with the lining paper used carelessly.

IN response to certain potato dealers' expressions of difficulty in correlating the various Regulations concerning the use and distribution of seed potatoes, the following summary has been prepared :—

**Seed Potato
Regulations.**

In the first place, dealers in potatoes of any kind must obtain a certificate of registration as a dealer, wholesale or retail, as the case may be, from the Ministry of Food. (The Potatoes Order, 1919, issued by the Ministry of Food.*)

In the case of any Sale, dealers must correctly declare to the purchaser on the invoice, sale note, or label, the variety, class, and size of dressing of the seed potatoes sold. With regard to the "class," Class 1 comprises Scotch and Irish seed; Class 2, seed once grown; and Class 3, seed twice grown from Scotland or Ireland. (The Seed Potato Order, 1918, issued by the Ministry of Food.†)

In the case of a purchase of Seed from Ireland, dealers must buy only from a holder of a licence issued by the Department of Agriculture and Technical Instruction for Ireland and request the seller to see that the consignment is accompanied by a certificate issued by the Department to the effect that the potatoes have been inspected and passed as sound. (The Potatoes (Export from Ireland) Order, 1919, issued by the Ministry of Food.)

In the case of a purchase of Seed from Scotland, dealers must obtain from the grower a declaration that Wart Disease has not occurred on the farm from which the seed is coming, and from the Board of Agriculture for Scotland, not more than seven days before the potatoes are consigned, a certificate that Wart Disease has not occurred, either on the farm, or within one mile of the farm. So that the delivery of seed potatoes may not be delayed, it will be sufficient if the loader rather than the purchaser obtains both declaration and certificate, provided that the loader declares in writing to the purchaser on the invoice that he holds these documents. (The Wart Disease of Potatoes (Scottish Seed Potatoes) Order, 1919, issued by the Board of Agriculture and Fisheries.‡)

In the case of a Sale of Immune Varieties for planting within an Infected Area, if the dealer holds stocks of seed potatoes from crops which were inspected whilst growing and certified by the Board of Agriculture and Fisheries, the Board of Agriculture

* See this *Journal*, December, 1919, p. 946.

† " " " " January, 1919, p. 1235.

‡ " " " " April, 1919, p. 106.

for Scotland, or the Department of Agriculture and Technical Instruction for Ireland, as true to type and reasonably free from rogues, he must furnish the buyer in the invoice or other written document with the serial number of the certified stock in question. It is, of course, an offence to sell as of an approved immune variety seed potatoes not of an approved immune variety, or to sell as certified stocks, stocks which have not been so certified. Immune varieties not so certified cannot be sent into an Infected Area unless a licence has been obtained from the Board of Agriculture and Fisheries, but it should be noted that the Board do not propose to issue such licences until they are satisfied that the supply of certified stocks has been exhausted. (The Wart Disease of Potatoes Order, 1919, issued by the Board of Agriculture and Fisheries.)*

In the case of Varieties not immune from Wart Disease stored in shops and warehouses within, for the supply of Customers outside, an Infected Area, dealers must obtain a licence from the Board of Agriculture and Fisheries and strictly adhere to the conditions of such licence. (The Wart Disease of Potatoes Order, 1919, issued by the Board of Agriculture and Fisheries.)*

In the case of a Sale of Potatoes for planting in land not within an Infected Area, dealers must sell only those varieties which have been grown in clean districts. It should be noted that certified stocks of immune varieties bearing the letter "I" before the serial number have been grown within an infected area. (The Wart Disease of Potatoes Order, 1919, issued by the Board of Agriculture and Fisheries.)*

Any seed potato dealer experiencing difficulty with regard to any of the above Regulations should communicate with the Secretary, Horticultural Division, Ministry of Agriculture and Fisheries, 72, Victoria Street, London, S.W. 1.

BEE-KEEPERS will find that it is cheaper to make their own candy than to buy it, and the following hints may be useful to those who for any reason prefer the home-made variety. It is well to remember that during winter bees should be fed on soft candy placed over the clustering bees under the quilts; syrup is used for spring, summer and autumn feeding.

Soft candy can be made as follows :—Have a clean pan, for preference a brass preserving one, into which put 3 lb. of best white lump cane sugar (brown sugar should on no account be used) and half a pint of water, together with as much cream of tartar as can be heaped upon a sixpenny-piece. Stand beside the fire, stirring occasionally until the sugar is dissolved, and then place on the fire and stir continually until the mass

* See this *Journal*, November, 1919, p. 841.

boils. Allow it to boil for about two minutes, and then remove from the fire and stand the pan in another vessel containing cold water until the sugar begins to cloud; then stir well and pour into prepared glass-topped boxes made by glazing one side of a section, or into saucers lined with paper, so that when cold it can be lifted out in a block. When set, it should be a moist solid mass easily cut into with the finger nail.

Candy given in January should have about a quarter of a pound of pea flour mixed with the above quantity. This is best done during the cooling process. The flour should not be poured in all at once, but lightly sprinkled in while stirring, so that it mixes evenly right through the candy.

When the candy is made with plain sugar it is advisable to medicate it with a disinfectant. Izal, Bacterol, or Flavine can be used for this purpose in the following proportions:—

One teaspoonful of Izal to 8 lb. of sugar.

One teaspoonful of Bacterol to 1 lb. of sugar.

One grain of Flavine to 1 lb. of sugar.

To medicate when dealing with Foul Brood there should be added to each pound of sugar as much Naphthol Beta as can be heaped upon a three-penny piece. This should be dissolved in sweet spirit of nitre, whisky, or methylated spirit. The disinfectant in all cases should be added when the syrup or candy is cooling, not when it is hot.

The Royal Commission on the Sugar Supply have agreed to issue to all registered bee-keepers a ration of bee food of 6 lb. of sugar per stock for the period January to May, 1920.

Government Policy.—The Parliamentary Secretary to the Board, in reply to a question by Major Courthope, stated that a Bill was being drafted by the Board to carry out generally the agricultural policy outlined by the Prime Minister, but that he was not in a position to give details at the present moment. As stated by the Prime Minister the Bill will be introduced early next Session. (8th December, 1919.)

Compulsory Ploughing Orders.—In reply to a question by Sir F. Blake, the Parliamentary Secretary to the Board stated that the Government's scheme for increasing the area under the plough was carried out in 1917 and 1918 as an emergency measure necessitated by the pressing need for rapidly increasing the home production of food. The work was undertaken by local committees of practical men familiar with the districts. Farmers were, as a general rule, notified of the intended visit of the person or persons deputed to select grassland to be broken up. They were also invited to suggest suitable land, and, in any case, every farmer had ample opportunity after he had been served with a Cultivation Order of stating his views to the committees and of suggesting alternative land. It was competent for any person who considered that he had suffered loss as a result of a compulsory ploughing Order to submit a claim for compensation to the Board through his County Agricultural Executive Committee up to the 31st July last. (18th December, 1919.)

Flax Proposals.—Replying to Major Courthope, the Parliamentary Secretary to the Board stated that in order to preserve the goodwill of the Board's flax factories and their products (whether the factories were in future carried on by the Board, or by private enterprise), the Board propose to contract, if possible, for 5,000 acres of flax to be grown in 1920. The price offered will be £13 per ton, with a possible bonus of £2 per ton at the Board's discretion, for flax of exceptionally high quality, seed to be provided free. Purchasers of the factories will be required to take over these contracts, as indicated in the advertisements which have appeared. (8th December, 1919.)

Hops.—In a question by Mr. McCallum Scott the Parliamentary Secretary to the Board was asked whether under the Defence of the Realm Act the acreage under hops has been reduced from about 36,000 to about 16,000 acres, and whether the Government contemplated any special legislation to protect the cultivation of hops in this country. In reply the Parliamentary Secretary to the Board stated that the area under hops was reduced under the Defence of the Realm Act from 31,352 acres in 1916 to 15,666 acres in 1918, and that the area this year was 16,748 acres. Trading in English hops of the 1919 crop had not yet commenced, and the Hop Control Committee had no information as to the prices at which imported hops were being sold in this country. With regard to the last part of the question he referred the Hon. Member to Section 9 (1) (d)* of the Imports and Exports Regulation which is at present before the House.

The Parliamentary Secretary, in answer to further questions by Mr. McCallum Scott, stated that he was aware that an average price was being paid by the Hop Control Committee of £18 5s. a cwt. They were now busy grading the crop, and he could not say at what price any quality was being sold. He also stated that English hops of the 1919 crop were not being sold at a considerably lower price than imported hops. (8th December, 1919.)

Feeding Stuffs.—In reply to a question by Mr. Herbert, the Parliamentary Secretary to the Ministry of Food stated that all descriptions of feeding cakes and meals might be freely purchased. The only form of control now in existence was a system by which the sales of feeding cakes and meals were licensed by an association of the traders acting in co-operation with, and under the supervision of, the Ministry of Food, for the purpose of eliminating speculators and limiting prices. No restrictions were imposed on the freedom of farmers to purchase feeding cakes and meals as and where they please, for their own use. (15th December, 1919.)

Fertilisers.—In reply to a question by Lieut.-Col. Sir N. Griffiths, the Parliamentary Secretary to the Board stated that the Fertilisers Prices Order, 1918,† under which control was exercised over sales and purchases of the fertilisers, ceased to operate on 31st May, 1919. Since that date maximum delivered prices of basic slag and sulphate of ammonia for home deliveries had been fixed by agreement between manufacturers and the Board. No maximum prices had been arranged for superphosphate on account of the varying cost of importing phosphate

* "With a view to assisting the industry of hop-growing in the United Kingdom to recover from the injury which it has suffered during the present War, at any time within a period of four years from the termination of the present War, the Board of Trade will prohibit the importation of hops."

† See this *Journal* May, 1918, pp. 220-221, and June, 1918, p. 359.

rock. Apart from these arrangements, the production, distribution, and prices for home consumption of these fertilisers were now free from control. Control of export of fertilisers was still maintained, in order to secure sufficient supplies to meet home requirements. Export licences for any surplus were, however, freely granted. This control would be discontinued as soon as practicable, consistent with meeting the needs of British agriculture. (22nd December, 1919.)

Grassland.—In reply to a question by Major Howard, the Parliamentary Secretary to the Board stated that the Board were aware that a certain amount of recently-ploughed grass land was being resown with grass, but that he hoped that the declared policy of the Government with regard to agriculture would allay the apprehensions of farmers and encourage them to maintain and extend the area of arable land. (22nd December, 1919.)

Butter and Cream.—In reply to a question by Sir R. Thomas as to the present controlled price of butter, and of Lieut.-Colonel Weigall as to the present veto in the sale of cream, Mr. Roberts stated that he was aware that the maximum retail price of butter was not on a parity with the price of milk, but that the present scarcity of butter was mainly due to the serious reduction in the quantity of imported butter available. As he had already stated, he was considering the question of freeing all home agricultural products, except wheat, at some point or points during the first six months of next year (*i.e.*, 1920), and the remission of the present restrictions on the sale of cream would be dealt with in connection with the general question. (22nd December, 1919.)

Bee Disease.—In reply to a question by Lieut.-Col. Bell, the Parliamentary Secretary to the Board stated that the Board were aware that British beekeepers had during recent years suffered severe losses owing to the prevalence of disease, and particularly Isle of Wight disease, among bees. With the object of preventing these losses by the means of combating disease, the Board had established an institute for the study of bees and bee disease, and at the present time investigations were being carried out both at Oxford and at Cambridge. The Board have, moreover, as a result of inquiries which they had made during 1918, satisfied themselves that hybrid bees of Italian and Dutch origin possess a marked resistance to Isle of Wight disease, and they had accordingly, and with the co-operation of county committees, introduced a Bee Restocking Scheme to establish breeding apiaries for the production of resistant hybrids. In accordance with this scheme they had introduced Dutch stocks and Italian queens, and supplied them at reduced prices to the Committee for breeding purposes. The scheme was developing satisfactorily, and during 1919, 1,171 hybrid nuclei had been raised from 251 stocks. It was proposed to continue the production of nuclei in the coming year, and it was expected that it would result in the establishment of large numbers of resistant bees. To ensure this result the Board hoped to provide for further importation of Italian queens during 1920. The question of introducing legislation with the object of stamping out bee diseases was now under the consideration of the Board. (22nd December, 1919.)

OFFICIAL NOTICES AND CIRCULARS.

CONSEQUENT upon the passing of the "Ministry of Agriculture and Fisheries Act, 1919,"* the King has been pleased to

**Appointment of
Minister
of Agriculture.**

appoint the Right Hon. Lord Lee of Fareham, G.B.E., K.C.B., to be Minister of Agriculture and Fisheries.

THE Rats and Mice (Destruction) Act, 1919, which received the Royal Assent on the 23rd December, came into operation on the 1st

**The Rats and Mice
(Destruction)
Act, 1919.**

January. The powers vested in Local Authorities under the Act are briefly explained in a Circular Letter addressed to Local Authorities by the Board on 30th December. The Board point out that, although an "occupier" of "land" is required under a penalty of £5 to take action to free his premises of rats and mice, provision is made for service by the Local Authority, or any Committee of the Local Authority to which the exercise of powers may be delegated, of a Notice on the "occupier" requiring him to take such steps as are prescribed in the Notice, within a time specified therein, and that this can be enforced by a fine of £20. The Local Authority may also, after not less than 24 hours' notice to the "occupier," enter upon the "land" and take such steps as are necessary and reasonably practicable for freeing the premises from rats and mice, and may recover all reasonable expenses so incurred. A notice purporting to be signed by the Clerk of a Local Authority shall, in the absence of proof to the contrary, be deemed to have been signed by the Clerk with the authority of the Local Authority. The expression "occupier" means, in the case of land which is unoccupied, the owner; and "land" includes any buildings and other erection on land, and any cellar, sewer, drain or culvert in or under land. The Act applies to a vessel as if the vessel were land, and the Master shall be deemed to be the occupier. Proceedings under the Act are only to be instituted by or with the authority of the Board or the Local Authority.

Experience gained by the Board from the supervision of administration of the Rats Orders has demonstrated that without the services of a competent and trustworthy officer to organise and control the necessary measures, the general co-operation and uniformity of action which are essential to success cannot be secured. It has shown on the other hand that where such officers are appointed a scheme on self-supporting lines can be organised and valuable results achieved. Local Authorities are urged, therefore, to adopt this procedure without delay.

THE following Circular Letter (No. 264/C.6) was addressed to County Councils and Councils of County Boroughs in England and Wales by the Board on 22nd December last:—

**Present Position of
Land Settlement.**

SIR,—1. I am directed to forward for the consideration of your Council the enclosed extracts† from the Proceedings of the Conference held on 21st October last between the President of the Board and representatives of Small Holdings Committees of the County Councils.

* See p. 962.

† Not here printed.

2. Lord Lee desires me to take this opportunity of expanding and emphasising certain points to which he referred, as some members of the Committees seem still not quite clear as to the Board's policy.

3. *Preference to ex-Service Men.*—I am to lay stress on the necessity for giving an absolute preference to ex-Service men. The amount of twenty millions provided in the Act for Great Britain will be no more than adequate to provide holdings for ex-Service applicants, and, until their claims are satisfied, it is imperative that none of it be spent on settling civilians except in very special cases.

So strongly does Lord Lee feel on this matter that Councils are asked to enter into no arrangements for letting a holding to a civilian applicant unless they receive the written concurrence of the District Commissioner.

4. *Applicants cannot dictate Choice of Land.*—Some Small Holdings Committees seem to think that if applicants demand holdings near their present homes or in some particular district, land must be specially acquired to meet their wishes.

This is wholly a mistaken view of the Government's pledge to ex-Service men, which was simply to provide suitable holdings; not to acquire scattered pieces of land to suit individual tastes.

The latter method, if pursued, will involve the Government in serious and needless expenditure on compensation for severance (by cutting small holdings off existing farms) and extra cost in building isolated cottages, and will saddle the Council with more difficult and costly management in the future.

Moreover, it is contrary to the declared policy of the Board, which is to group small holdings together in large blocks, so that the settlers, by co-operative purchase and marketing, may have the best chance of securing a good livelihood.

Exceptions to this general rule should be few, but may include the provision of land without equipment in small parcels for men who have other occupations.

5. *Rents of Council Holdings.*—Several counties have pointed out to the Board that in present conditions there is a danger of the rents charged to ex-Service men being higher than those paid by pre-war tenants of the Councils for similar holdings. The opinion has been expressed that it would be grossly unfair if a man who had risked his life in the service of his country were settled on a holding adjacent to another man who had remained on the land throughout the War, and were required to pay a rent 50 per cent. or 60 per cent. higher than his neighbour.

The problem is admittedly a difficult one, and has been fully considered by the Cabinet. As a result the Government desire each Council to reconsider forthwith the existing rents for pre-war holdings and to make such additions thereto as will bring them into closer agreement with the changed value of agricultural land. In determining the amount of the new rent, Councils should not take into account improvements effected by their tenants. Nor should they have regard to the change in the rate of interest charged on loans raised now for the purchase and equipment of land. The Government do not desire Councils to rack-rent their tenants. They are satisfied, however, that in view of the advance in the capital value of agricultural land, the rents of County Council small holdings should, in most cases, be considerably increased and brought into relation with the rents charged by private

landowners, who work on a commercial basis, for small holdings similar in character to those provided by the County Council.

In this connection I am to remind the Council that in 1926 the small holdings undertakings will be valued as a whole on the basis of their then rental value. If the Council is not then obtaining rents equal to their full rental value the loss will fall on the Council itself.

6. *Advances to Settlers*.—The Regulations have now been made by the Treasury, and copies are enclosed herewith* with copies of a covering memorandum.†

I am, etc.,

(Signed)

LAWRENCE WEAVER,

Director-General of Land Settlement.

THE following Regulations, dated 8th December, 1919, have been made by the Treasury under Section 18 of the Land Settlement (Facilities) Act, 1919 (9 and 10 Geo. 5 Ch.

**Loans to Tenants
of Small Holdings
under the
Land Settlement
(Facilities) Act, 1919.**

59) :—

In pursuance of the powers conferred on them by Section 18 of the Land Settlement (Facilities) Act, 1919,† My Lords make the following Regulations :—

1. Any application by a tenant or prospective tenant of a small holding provided by a County Council for an advance or guarantee of an advance under the above section shall be addressed to the Clerk of the County Council.

2. Every application shall state the purpose or purposes for which the advance is required, which must be one or more of the following purposes, namely, the purchase of live stock, fruit trees, seeds, fertilisers and implements required for the purposes of the holding. The application shall contain an undertaking to apply the money advanced for the purpose authorised, and that if the money is used for any other purpose the Council may require its repayment forthwith.

3. The applicant shall state in every case the capital in cash or kind, other than the advance, which is or will be available for farming his holding, and whether any part of such capital is or represents borrowed money.

4. A County Council shall limit the sum to be advanced to any applicant to such amount as in the opinion of the Council does not exceed the amount of capital in cash or kind which the applicant is able to provide from other sources, except in any special case where the Council are of opinion that a larger amount might safely be advanced to the tenant, and the previous sanction of the Board of Agriculture and Fisheries has been obtained by the Council.

5. The amount of the advance shall not exceed the sum which the Council consider necessary for the purpose stated in the application, and in no case shall the advance or advances to any one applicant at any time exceed £500.

* See below.

† Not here printed.

‡ See this *Journal*, October, 1919, p. 735.

6. The period for the repayment of an advance shall be determined by the County Council at the time of sanctioning the advance, and must not be extended subsequently except with the specific approval of the Board of Agriculture and Fisheries. The period shall be determined in accordance with the following rules :—

- (a) The period of each advance shall not exceed the period during which in the opinion of the Council the applicant may reasonably expect to recoup the expenditure proposed ; and
- (b) In the case of advances for the purchase of live stock, fruit trees and implements, the period shall not exceed three years, provided that in exceptional cases it may, with the special sanction of the Board of Agriculture and Fisheries, be extended to the maximum of five years from the date of the advance, and in the case of advances for the purchase of seeds or fertilisers the period shall not exceed two years.

7. On approval of an application instructions given by or on behalf of the Council will be sent to the applicant's Bank by which the money will be advanced to the applicant as he requires it, and such instructions will cover the Bank's advances up to the amount authorised by the Council on the amount and for the period which the Council authorise the advance to be made with interest at a rate not exceeding five per cent. The Council will give to the Bank a guarantee for such advances and interest in such form as they may agree. An advance shall not be made by a County Council otherwise than through the applicant's Bank except with the sanction of the Board of Agriculture and Fisheries.

8. At the time of approving an application for an advance the Council shall determine within what period the applicant shall be required to satisfy them by the production of receipted invoices, or otherwise, that the advance has actually been expended for the purpose for which it was sanctioned. If an applicant fails to comply with any such requirement the Council may by notice to the applicant and the Bank reduce the amount of the advance authorised and require repayment by the applicant forthwith of any amount expended for a purpose for which it was not sanctioned.

9. The interest payable to a Bank in respect of an advance made under these Regulations shall be paid quarterly, or at such other intervals as the Bank shall determine.

10. In any case of default in regard to the repayment of any advance reported by the Bank to the County Council, the Council will repay to the Bank the amount due under their guarantee and take all possible steps to secure repayment. If any amount proves irrecoverable it should be reported by the County Council to the Board of Agriculture and Fisheries.

11. A Bank advancing money on a guarantee under these Regulations shall not be responsible for the application of the money advanced.

12. Advances under these Regulations shall only be approved where in the opinion of the County Council the facilities for obtaining advances from a society on a co-operative basis are inadequate.

13. These Regulations apply to tenants of Holdings provided by a Council of a County Borough with the following modifications :—

- (a) For " County Council " there shall be substituted " Council of a County Borough," and
- (b) For " Clerk of the County Council " there shall be substituted " Town Clerk,"

and to the tenants of holdings provided by the Board of Agriculture and Fisheries with the following modifications :—

- (i.) For "County Council" there shall be substituted "Board of Agriculture and Fisheries," and
- (ii.) For "Clerk to the County Council" there shall be substituted "The Secretary to the Board of Agriculture and Fisheries."

Given under our hands this 8th day of December, 1919.

(Signed) JAMES PARKER.

" J. TOWYN JONES.

*Two of the Lords Commissioners of
His Majesty's Treasury.*

THE Food Controller has issued an Order amending the Potatoes Order, 1919.* The effect of the new Order is to prohibit the use of any potatoes which are fit for human

Potatoes Order, 1919: consumption (except potatoes which will pass through a 1½-in. riddle) for any purpose other than planting or human consumption.

Such potatoes may not be used for the manufacture of spirits or farina or for the manufacture of any article which is ordinarily used for any purpose other than human food. The Order came into force on 1st January, 1920, and does not apply to Ireland.

AN Order (No. 1806), dated 6th December, 1919, has been made by the Food Controller revoking as on the 15th December, 1919, the British Onions Order, 1918,† but without prejudice to any proceedings in respect of any contravention thereof.

**The British Onions
Order, 1918.**

THE Food Controller has made an Order (No. 1798), dated 4th December, 1919, to the effect that :—

**The Cheese
(Distribution) Order,
1918.**

1. On and after the 9th December, 1919, until further notice, no Government cheese which is produced in the United Kingdom shall be sold by retail at a price exceeding a price at the rate of 1s. 8d. per lb.

2. (a) No charge may be made for packing or packages or for giving credit.

(b) Where the cheese is delivered at the buyer's request otherwise than at the seller's premises, an additional charge may be made in respect of such delivery not exceeding a charge at the rate of ½d. per lb., or any larger sum actually and properly paid by the seller for carriage.

3. The directions under the above Order (The Cheese (Distribution) Order, 1918), dated the 8th March, 1919,‡ are hereby revoked as from the 9th December, 1919, so far as the same relate to Government cheese produced in the United Kingdom, but without prejudice to any proceedings in respect of any contravention thereof.

* See this *Journal*, December, 1919, p. 946.

† See this *Journal*, November, 1918, p. 1006.

‡ Not printed in this *Journal*.

THE Food Controller issued an Order (No. 1686), dated 22nd November last, which fixes the maximum prices at which, and prescribing the condition under which, all eggs

Egg Prices. other than plovers' and gulls' eggs may be sold. The principal provisions of the Eggs (Prices) Order, 1918,* are re-enacted, and the schedule of maximum prices given in that Order remains unaltered, except that maximum prices are fixed for Chinese eggs, the maximum retail prices for which are 4d. each.

AN Order (No. 1826), dated 10th December, 1919, has been made by the Food Controller revoking as from the 15th December, 1919, the Horse and Poultry Mixtures Order, 1917, as amended,† but without prejudice to any proceedings in respect of any contravention thereof.

AN Order (No. 1847), dated 13th December, 1919, amending the Poultry and Game (Prices) Order, 1918, has been made by the Food Controller to the effect that:—

1. Sub-Clause (iii.) of Clause 4 of the Poultry and Game (Prices) Order, 1918. Principal Order‡ shall be deleted.
2. The Schedule to this Order shall be substituted for the Schedule to the Principal Order.

THE SCHEDULE.

Maximum Prices for Poultry and Game.

	First Column. (Retail.)		Second Column. (Other than retail.)	
	Price at the rate per lb.	Price for the Bird.	Price at the rate per lb.	Price for the Bird.
	s. d.	s. d.	s. d.	s. d.
Ancona and Leghorn (white, black or brown) Cockerels weighing not less than 6 oz., and not more than 1 lb.	—	2 2	—	2 8
Any other Cockerel and any Pullet, Cock or Hen, including Capon	2 2	—	2 8	—
Domestic Duck	1 10	—	2 3	—
Turkey	2 2	—	2 8	—
Goose	1 4	—	1 8	—
Guinea Fowl	—	5 6	—	7 0
Grouse and Black Game . .	—	2 6	—	3 3
Partridges, young birds (hatched in the year 1919, sold prior to 1st January, 1920)	—	3 3	—	4 0
All other Partridges . . .	—	1 9	—	2 3
Pheasants (Cocks)	—	5 6	—	7 0
" (Hens)	—	5 0	—	6 6

* See this *Journal*, December, 1918, p. 1128.

† " " December, 1917, p. 1023, and June, 1918, p. 353.

‡ " " August, 1918, p. 600, and October, 1918, p. 901.

THE Board again call the attention of nurserymen and others to the new Gooseberry Mildew Order which revokes all previous Orders dealing with this disease except the Fruit American Gooseberry Orders of 1915 and 1919,* (Orders referring to the importation of fruit and the consignment of diseased fruit to markets).

Under this Order notification of disease is required from persons growing gooseberry and currant bushes for sale. It is illegal to sell gooseberry or currant bushes affected with the disease, but a grower, after notification, may prune away all diseased tips and then sell the bushes without a licence. The onus of seeing the bushes are free from disease rests with the seller. All restrictions on the movement of gooseberry or currant bushes which have been in force in Wisbech, Kent, Worcester, etc., are removed, but the new Order enables an inspector to forbid the removal of visibly diseased bushes and also to deal with diseased bushes moved in contravention of the Order. The Board retain power under the Order to deal with fruit growers and private owners who fail to take proper steps to check the disease.

The importation of gooseberry bushes is still prohibited, but that of currant bushes is now allowed without licence.

The Board regret to find nurserymen and growers of bushes for sale are not exercising the necessary care and removing the tips before selling the bushes. The Board will strictly enforce the provisions of the Order dealing with the sale of diseased bushes, and in such cases of contravention reported to them are instituting legal proceedings.

For a long time past large tracts of sheep-farming land in Scotland and the North Tyne district of England have known a sheep disease popularly called Louping-ill. Of late it has

Louping-ill in Sheep.

been so destructive to the flocks, particularly to lambs, that the farmers in the North Tyne country applied to the Board of Agriculture for advice and assistance, and Sir Stewart Stockman, Chief Veterinary Officer of the Board, recently met a representative gathering of sheep farmers and shepherds at Bellingham in Northumberland, where a conference was held to discuss the application to practice of the results of research on this disease. Sir Stewart Stockman's own inquiries into the pathology of Louping-ill were published at some length in the issue of this *Journal* for April, 1919, and he was able to give the meeting an assurance that the farmers have the remedy in their own hands provided it suits their business to adopt it. By taking the proper measures they can clean up thousands of acres of infected pastures. The investigations show that Louping-ill is a tick-born disease. The ticks feed on blood of an infected sheep and afterwards pass infection on to the other sheep upon which they feed. The obvious method of eradicating the disease is to free the pastures of the ticks by stocking each part of the pasture heavily in turn with sheep to catch the ticks, and then dipping the sheep in an anti-tick bath. The ticks attack the sheep in order to feed on their blood and remain attached to their bodies for about five days; dipping with intervals of five days will, therefore, catch the greatest number of ticks on the sheep. Another method to be used in conjunction with the dipping is to drive the sheep from tick-infested

* See this *Journal*, June, 1919, p. 339.

pastures into a pen littered with damaged straw or other rubbish of a combustible kind. Once in the pen the sheep are driven round, and this disturbance shakes the gorged ticks on to the straw. After a time the sheep are driven out of the pens, and the straw or whatever other litter is employed is burnt, the ticks being destroyed with it. By the adoption of these methods it is believed that tick-infected pastures can be gradually cleaned, and the costly mortality among the flocks very greatly reduced and in time even eradicated. Experiments are to be conducted with a serum which will be injected into sheep suffering from Louping-ill, and it is hoped that this remedy may prove effective in decreasing losses during eradication, but eradication should be the main object. Farmers and shepherds in Northumberland are anxious to adopt any measures that may be either preventive or curative, and Sir Stewart Stockman has agreed to advise upon and supervise any operations for the eradication of Louping-ill which farmers may undertake.

For some time past certain mischievous rumours have been circulating in England and Scotland, particularly in Scotland, with reference to the Board of Agriculture's Testing Station at Pirbright in Surrey. It is difficult to overtake rumour, but it is desirable that in the present case the rumours should as far as possible be met. The result of misleading statements are on occasion of quite another kind to that which was intended by the originator. The following letter has been received by the Board from a prominent cattle breeder of Scotland—

**The Pirbright Cattle
Testing Station :
Mischievous Rumours
denied.**

"I had to be in London last week and went out to Pirbright. I am glad I went. I was anxious to see the conditions under which the animals are kept, and I shall now be able to refute entirely the mischievous reports, born of ignorance and prejudice, that are circulating among cattle dealers in England and Scotland. In my opinion the animals at Pirbright are being kept under ideal conditions, and I was more than pleased with everything I saw, so far as the condition of the animals is concerned. I think the Board have an exceedingly capable veterinary inspector and I shall have no hesitation in sending further animals to be tested.

"Of course, in Scotland, as you will entirely understand, we would much prefer to avoid the expense of sending animals to Surrey and be put to the further expense of bringing back any which may unfortunately react. There is a further difficulty that breeders may object to take back animals which have been in the south of England in a district not far removed from cases of Foot-and-Mouth Disease. I have had occasion to be in Berkshire, Herefordshire, Shropshire and Cumberland since my visit to Pirbright, and while looking for animals for export I took the opportunity of disabusing the minds of breeders of the prevailing notion that their animals might get mixed up with others at Pirbright and run the risk of contamination. I assured them that every animal is absolutely isolated and that every care and attention are given to them."

The Board have received this letter with the greatest pleasure, because it supplies much needed information and correction to those who have confused rumour with truth.

ALL who have lately acquired agricultural estates, and farmers who have recently come into possession of their farms, will doubtless be a little puzzled to find a half-yearly or

How to Redeem Tithe. yearly summons to pay tithe. There is no reason to doubt that many owners of land would prefer to rid themselves of the liability. Thanks to the Tithe Act of 1918 this is readily done, and at a reasonable cost; indeed, during the past twelve months applications for redemption of tithe rent-charge amounting to £21,513, and to capital values of about £300,000, have reached the Board. Although the tithe included in these applications must be regarded as considerable, being, for example, nearly eleven times as much as that in the applications received during the pre-war year, 1913, the Tithe Act of 1918 has not completely fulfilled the hopes of some of its supporters. Applications would undoubtedly have been larger but for the widespread belief that redemption proceedings involved landowners in a considerable amount of trouble. Nothing more, however, is required in the great majority of cases than that the applicant should write to the Board of Agriculture, giving particulars of the tithe rent-charge he wishes to redeem, together with the names and addresses of the owner and collector of the charge. All other work falls upon officers of the Board.

It is of interest to note that at the moment, where tithe rent-charge is payable to the incumbent in right of his benefice, the cost of redemption is about 17 years' purchase of the present annual value. Where tithe rent-charge is otherwise held, the consideration is about 15½ years' purchase. Persons who cannot supply correct particulars of the tithe rent-charge should send to the Board a plan of their property, preferably on a 1/2,500 scale Ordnance sheet, with boundaries of the land to be redeemed clearly and accurately set out with a coloured edging. If any further particulars are desired, they can be obtained, together with the necessary forms of application, free of all charge, on application to the Board.

It is generally admitted that the common lands in England and Wales are not only important as means of livelihood for small holders and others who live upon their boundaries,

**Common Lands and
How to Protect
them.**

but also as a source of fresh air and recreation to town dwellers. From time to time, however, the Board receive complaints as to encroachments or illegal inclosures of common land which are gradually reducing the area of the common lands in this country. In this connection it may be useful to note that Section 30 of the Commons Act, 1876, provides that a County Court within whose jurisdiction any common or part thereof is situate may grant an injunction against or make an order for the removal or abatement of such inclosure or encroachment. Under Section 26 (2) of the Local Government Act, 1894, a District Council may in certain circumstances aid persons in maintaining rights of common. As a rule, however, the most effective method of putting a stop to encroachments on a common is by means of a scheme made by the Urban or Rural District Council with the approval of the Board under the Commons Act, 1899, for the regulation and management of the common. The necessary forms and regulations under the Act may be obtained from the Board post free on application.

LORD IVEAGH, who has done so much for deserving causes, is anxious to help those sons of agricultural labourers who are bright, intelligent and fit for more responsible work than that

**A Farm School for
Suffolk: Gift from
Lord Iveagh.**

which would fall to their lot in ordinary circumstances, but are barred from advancement by lack of education. To this end he has purchased the Chadacre Hall Estate of some 500 acres in the County of Suffolk, and is prepared to defray the whole cost of establishing a Farm Institute for 40 or 50 boys who will be admitted at the age of 16 years, after some training on a farm. The Institute is intended primarily for the sons of poor parents, particularly of farm labourers, but sons of small farmers and small holders will be considered, together with cases recommended to the Governing Committee by Local Authorities, school managers, clergy and others. Lord Iveagh hopes that it will be possible for the Farm Institute to begin work at Michaelmas. No fees are to be charged, board, lodging and instruction being entirely free. Lord Iveagh's action will meet a need that some of those interested in agriculture have long recognised. There are many farm lads who need no more than the stimulus of sound training to enable them to take a prominent part in agricultural work, administrative as well as practical. The hope may be expressed that others who have the best interests of agricultural England at heart will emulate the good work of Lord Iveagh.

In the Report of the Government Chemist upon the work of the Government Laboratory for the year ended 31st March, 1919,* it is stated that the number of samples examined

**Report of the Work
of the Government
Laboratory, 1918-1919.**

for the Board of Agriculture and Fisheries, the Board of Agriculture for Scotland and the Department of Agriculture and Technical Instruction for Ireland was 581, as compared with 1,568 in the previous year.

Sheep Dips.—Twenty-six samples of sheep dips were received for examination in connection with applications by manufacturers for inclusion of their preparations in the official "Schedule of efficient dips." Before the Board give their approval to any dip they must be satisfied that the formula provides for a sufficient quantity of a recognised active ingredient and that the dip has been made in accordance with the formula. In 15 cases the samples were found to agree with the formula, and were of effective strength at the proposed dilution; six were deficient in active ingredients at the dilution submitted by the makers; in the remaining five cases the formulæ required modification to ensure an efficient dip. Four samples of approved dips obtained in different parts of the country were also examined with the object of ascertaining whether the dips as sold or used correspond in composition with the samples which had received the Board's approval. The analyses showed that one of these had not been prepared according to the formulæ previously submitted and approved.

The miscellaneous samples examined for the Board included samples for the Food Production Department, waste materials, as to their value as fertilisers; cattle feeding stuffs; basic slag; potash materials; seeds; insecticides and manures.

* Cmd. 419, 1919. Obtainable from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, price 2d. net.

Questions submitted by the Board for Report.—It is stated that in the course of the year numerous matters were submitted by the Board for report. Many of these related to the value of materials supplied as feeding stuffs, and to the supply of potash and phosphatic manures. The official method for the determination of potash in fertilisers has been revised and a new method drawn up for use in the case of flue dust (F. & F. Stuffs (methods of analysis) Regulations No. 659, 1918).

Flax Retting.—A number of samples of water proposed to be used for retting flax were analysed.

Fertilisers and Feeding Stuffs Act.—The samples under this Act were submitted by the Board in connection with applications by local authorities for the consent of the Board to proceedings against the sellers. The number of samples received was 11, consisting of 5 fertilisers and 6 feeding stuffs, as against 20 in the previous year.

The fertilisers consisted of superphosphate, basic slag and sulphate of ammonia.

The feeding stuffs examined consisted of feeding meals and cakes, milling by-products and poultry foods. Several of the meals contained a considerable proportion of substances unsuitable for feeding purposes.

SINCE the date of the list given on pp. 345-6-7 of the issue of this *Journal* for June last, the following leaflets have been issued in the *Permanent Series* :—

**Leaflets Issued by
the Ministry.**

No. 330.—*Apple Aphides.*

„ 331.—*Canning of Fruit and Vegetables.*

(Previously issued as F.P. Leaflet No. 34).

No. 332.—*Liquid Manure.*

„ 333.—*Fish Meal as a Food for Live Stock.*

In addition, the information in the following *Leaflets* has been revised and brought up to date :—

No. 26.—*Tenant Farmers, Income Tax, and Accounts.*

„ 100.—*The Breeding and Management of Pigs.*

„ 137.—*Potato Scab*

„ 105.—*Wart Disease.*

„ 141.—*The Preparation of Honey for Market.*

„ 153.—*Storing of Turnips and Mangolds.*

„ 162.—*Propagating Apples, Pears, Plums and Cherries.*

„ 167.—*Ducks and Duck-breeding.*

„ 178.—*Onion Mildew.*

„ 180.—*Dodder.*

„ 197.—*Agricultural Education and Research in England and Wales.*

„ 198.—*Rearing and Marketing of Geese.*

„ 207.—*Strawberry Cultivation.*

„ 235.—*Organisation of the Milk Supply.*

„ 244.—*The Destruction of Rats.*

„ 253.—*Microsporidiosis of Bees, or Isle of Wight Bee Disease.*

„ 290.—*The Cattle Testing Station of the Board of Agriculture and Fisheries.*

„ 297.—*Seed Testing.*

„ 298.—*Pig-keeping for Cottagers and Smallholders.*

„ 309.—*Suggestions to Allotment Holders for Autumn Treatment of Land.*

„ 317.—*The Rearing of Chickens.*

No. 321.—*Notes on Essential Points in Poultry Keeping.*

„ 323.—*The Profitable Utilisation of Surplus Milk.*

Food Production Leaflet No. 59.—Economy in the Use of Hay.

The following *Permanent Leaflets* have been withdrawn from circulation :—

No. 76.—*Cucumber and Melon Leaf Blotch.*

„ 87.—*A Fungus Disease of Young Fruit Trees.*

• „ 116.—*Sleepy Disease of Tomatoes.*

„ 143.—*The Turnip Mud Beetle.*

„ 144.—*Heart Rot of Beet, Mangold and Swede.*

„ 165.—*Gall Gnats injurious to Willows and Osiers.*

„ 185.—*Bean Pod Canker.*

„ 216.—*The Administration of the Small Holdings Act.*

„ 217.—*The Provision of Allotments.*

„ 271.—*Clover Sickness.*

„ 281.—*Apple Leaf-Spot.*

„ 316.—*Sorghum for Fodder.*

The following *Food Production Leaflets* have been withdrawn from circulation :—

No. 3.—*Notes on Poultry Feeding.*

„ 15.—*The Use of Sulphate of Ammonia as Manure.*

„ 18.—*Seed Testing for Farmers.* (Replaced by F.P. Leaflet No. 47).

„ 19.—*Pig Feeding in War Time.*

„ 26.—*Economy in the Use of Seed Grain.*

„ 43.—*Practical Hints on Potato Spraying.*

„ 54.—*The Cropping of Grass Land Broken up for 1918 Harvest.*

THE Government have announced the constitution of the Forestry Commission, which has been set up under the new Forestry Act. The names and qualifications of the Commissioners are as follows :—

Construction of the Forestry Commission.*

Lord Lovat (*Chairman*).—Owner of extensive woodlands and closely identified with forestry in Scotland. Director of Forestry, B.E.F., France, Member of the Forestry Reconstruction Sub-Committee and of the Interim Forest Authority.

Mr. F. D. Acland, M.P.—Chairman, Home-Grown Timber Committee, Chairman of the Forestry Reconstruction Sub-Committee, Chairman of the Interim Forest Authority.

Lord Clinton—Former President of the English Forestry Association. Member of the Interim Forest Authority

Mr. L. Forestier-Walker, M.P.—Will answer for the Commission in the House of Commons. Will represent Wales.

Sir John Stirling Maxwell.—Assistant Controller (Scotland), Timber Supply Department, Board of Trade. Honorary Secretary, former President, Royal Scottish Agricultural Society, Member of Forestry Sub-Committee. Will represent Scotland.

Mr. T. B. Ponsonby.—Member of the Interim Forest Authority. Identified with forestry in Ireland. Will represent Ireland.

Mr. R. L. Robinson.—Member of the Interim Forest Authority, Secretary, Forestry Reconstruction Sub-Committee. Formerly

* This Notice was omitted from last month's *Journal* owing to want of space.

head of Joint Forestry Branches of the Board of Agriculture and Office of Woods. Distinguished career at Adelaide and Oxford Universities in pure science and forestry.

Colonel W. T. Steuart-Fotheringham.—Member of the Interim Forest Authority. Assistant to Assistant Controller (Scotland), Timber Supply Department. Identified with forestry development in Scotland. Will represent Scotland.

THE following Circular Letter (No. 64,956/H) was addressed to the Councils of Boroughs (including Metropolitan Boroughs) and Urban and Rural Districts in England and Wales by the Board on 18th November :—

**By-laws affecting the
Breeding of Pigs
and Poultry.***

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to the Circular Letter which was issued by the Local Government Board on 28th May, 1918,† suggesting that Local Authorities should give encouragement in the keeping of pigs by not enforcing by-laws against such pig-keeping, provided that the interests of public health were not seriously jeopardised, and to say that the Board of Agriculture are receiving complaints from persons who have undertaken the keeping of pigs and poultry that they have been informed that in future the by-laws will be strictly enforced.

I am to point out that the Board of Agriculture are very strongly of opinion that the necessity for encouraging the keeping of pigs and also of poultry is still very great, and will continue to be so for the next few years, and under these circumstances I am to express the hope that your Local Authority will give all possible facilities consistent with the maintenance of public health for the keeping of pigs and poultry, and to that end, and, wherever local circumstances will allow, refrain from enforcing by-laws prohibitive of the keeping of such live stock.

I am, etc.,

(Signed) A. D. HALL,

Secretary.

THE Board desire to give notice of the publication of the eighth volume of the Special Reports on the Mineral Resources of Great Britain, which have been prepared by the Director of

Special Reports on the Mineral Resources of Great Britain. the Geological Survey in response to numerous inquiries that have arisen through the conditions brought about by the late War. Price 9s. net.

This volume, which is one of a series of six dealing with the subject of the iron ores of Great Britain, gives a general account of the geology of the hæmatite occurrences in West Cumberland, Lancashire and the Lake District, the nature of the ore bodies and the history of the development of the workings. The varieties and constitution of the ores are given in detail, with many analyses. Modern methods of mining are described and statistics of output and estimated reserves are given. The volume concludes with a detailed account of each mine.

Copies may be obtained through any bookseller from the Director-General, Ordnance Survey Office, Southampton.

* This Notice was omitted from last month's *Journal* owing to want of space.

† Not printed in this *Journal*.

THE Ministry of Food issued the following announcement to the Press on 9th January :—

De-Control of Dairy Produce.

The Food Controller, with the concurrence of the Minister of Agriculture and Fisheries and the Secretary for Scotland, has decided to discontinue, as from 31st January, various measures of control at present exercised over milk products.

Milk.—The Milk (Winter Prices) Order, 1919,* will be revoked as far as it pertains to prices, and thereafter milk may be bought or sold, whether by wholesale or retail, free from the restrictions on price imposed by the Order. Prices will be determined in the normal way by the free operation of supply and demand. The clauses (10), (11), (12), prohibiting the addition to milk of colouring matter or water, the reconstitution of milk, the use, without authority, of bottles or cans belonging to other persons, and the clauses (14) and (15) giving power to Food Committees, subject to the consent of the Food Controller, to buy and sell milk, to make arrangements for its distribution and to give directions for securing the purity and cleanliness and wholesomeness of milk, will remain in force. No alteration will be made in the Milk (Registration of Dealers) Order, 1918,† which prohibits retailers and wholesalers of milk carrying on business without a licence, but the retention of this Order will not interfere with the formation of co-operative depots under proper supervision. An Order will be issued, to take effect on 1st February, prohibiting the use of the terms "Grade A" or "Grade B" in connection with the sale of milk, except under licence by the Ministry of Food.

Cheese.—Home-produced cheese manufactured after 31st January, 1920, will not be purchased by the Ministry for the Pool, but will be free to find its natural market without restriction of price. The Ministry is purchasing hard home cheese, made during the month of January, 1920, and delivered to the Pool on or before February 29th, 1920, under the same terms and conditions as were in force in respect of the December make of such cheese.‡ The Ministry will continue to distribute the home cheese so purchased through the Home Cheese Distribution Scheme at controlled prices until further order.

Butter.—Home-produced butter will, as from 31st January, 1920, be freed from the existing control over prices, but the Ministry will continue to provide, through the Butter Distribution Scheme, the guaranteed ration of Government butter, *i.e.*, butter purchased and imported by the Ministry of Food, at a controlled retail price to all persons who have registered their ration card with a retailer of Government butter. Supplies of Government butter will also be continued to establishments under the existing procedure.

Cream.—The Cream Order, 1918, will be revoked as from 31st January, 1920, after which date cream may be made, sold, and purchased free from any restrictions.

Condensed Milk.—The maximum retail prices of condensed milk will be suspended as from 31st January, 1920.

In giving effect to these decisions the Food Controller must, of course, retain power in case of emergency to deal with any unforeseen difficulties which may arise.

* See this *Journal*, September, 1919, p. 650.

† " " April, 1918, p. 110.

‡ " " below.

THE Food Controller has issued a Notice under the British Cheese Order, 1917, fixing the maximum first-hand prices for the varieties of home cheese (except Caerphilly, Ripened Stilton, and Wensleydale Blue Cheese) manufactured during the month of January, 1920, and delivered up to and including 29th February, 1920. The prices are the same as those previously announced for cheese manufactured between 1st November and 31st December, 1919 (inclusive), in Great Britain, and Ireland, and delivered on or before 31st January, 1920, and published in the Note on p. 937 of last month's issue of this *Journal*. The Notice also provides that the maximum first-hand prices for cheese manufactured up to and including 31st December, 1919, (except in the case of Ripened Stilton and Wensleydale Blue Cheese which have been freed from the Order) apply to such cheese delivered up to and including 29th February, 1920, instead of 31st January, 1920, as previously stated.

Control of Home Cheese.

The following Memorandum was addressed to the London County Council and the Councils of Boroughs and Urban Districts in England and Wales by the Board on 1st January:—

Withdrawal of Allotments for Use for Building Purposes.

1. The Board consider it desirable to call the attention of Councils to the procedure which should be adopted as regards land entered on for allotments, under the Cultivation of Lands Orders, made under the Defence of the Realm Regulations, that is required for building.

2. As stated in the second paragraph of the Board's Circular Letter of the 23rd May last (C. L. 158/C. 6)* the Board consider that while the retention of land as allotments cannot be permitted to restrict the development of a town, or to prevent the erection of houses, factories, etc., no land cultivated as allotments should, as a general rule, be voluntarily given up for building purposes until shortly before the owner is in a position to commence building operations. In such cases Authorities should, therefore, satisfy themselves that the plans of buildings have been approved by the Local Authority, and that the building material is available to commence work.

3. Where a Council receive an application for land to be given up for building, they should first satisfy themselves, in accordance with the procedure outlined in the foregoing paragraph, that the case is one in which the Council should comply with the owner's request. They should then ascertain definitely from the owner the date on which he is in a position to start building in order that as long a notice may be given forthwith to the allotment holders, so that they may arrange to harvest any crops on the ground. While the Council should arrange to give as long a period of notice as possible to the allotment holders, they should fix a date for giving up possession so long ahead as to prevent the builder utilising the men and materials he may have ready for building on the site on the particular date named by him or the owner.

4. Cases have recently occurred where land has been required for building, and, owing to the long period of notice given by the Local Authority to the allotment holders, or even without any such excuse, the owner or builder has entered on the land, for the purpose of building, on a date prior to the date of the termination of the notices which have

* See this *Journal*, June, 1919, p. 333.

been given by the Local Authority to the allotment holders. The procedure outlined in paragraph 3 of this Memorandum should, therefore, be followed in future, and your Council should take steps to bring publicly to the notice of owners of land the fact that any unauthorised entry on land before the Council have withdrawn is an offence against the Defence of the Realm Regulations, and is punishable by a fine of £100, or six months' imprisonment, or both, and that if any cases arises in which an owner has wilfully entered on land without authority, your Council will not hesitate to obtain the necessary authority to institute legal proceedings against him.

5. Compensation to Allotment Holders on Dispossession.—The Board have obtained from the Treasury authority to pay, when necessary, as an act of grace, compensation to allotment holders dispossessed of their holdings within a period of two years after the termination of the War. This applies only to allotment holders on land entered upon by a Local Authority under the powers conferred on them by the Cultivation of Lands Orders, made under the Defence of the Realm Regulations. The compensation payable will be restricted to the value of the growing crops, and the labour expended and manure applied with a view to a future crop before the allotment holder received notice.

6. Local Authorities are urged to arrange, as far as possible, that

(a) where land is required for building or other industrial purposes, or

(b) where the compensation payable for continued possession of the land would be in excess of the value to the nation of the food produced,

the land should be given up at a time when there are few crops on the land, and that in any case in which there is a definite prospect of land being required for building next spring or summer, allotment holders should be warned not to plant crops or expend labour, or apply manure to crops which cannot be harvested before the date when the land will have to be given up.

THE following Circular Letter was addressed to Local Authorities in Great Britain under the Diseases of Animals Acts, 1894, to 1914, by the Board on 30th December :—

Double Dipping of Sheep.

SIR,—I am directed by the Board of Agriculture and Fisheries to refer to their Circular Letter to Local Authorities dated the 16th March, 1917 (A 303/C.),* relative to the question of the double dipping of sheep, and to say that the attention of the Board has been called from time to time to the fact that in some cases injury and sometimes deaths have resulted amongst sheep which have been dipped at intervals of less than 14 days. Inquiry in the matter has in every case elicited the fact that the sheep which had suffered had been dipped in poisonous dip on each occasion.

It is recognised that if a poisonous dip is used there is a risk of poisoning from bad handling of the sheep when dipping, and also from the sheep before they are properly drained being placed on confined pasture, and so poisoned from eating herbage which is contaminated by the draining from the sheep, and also by rain washing the poison out from the wool.

* Not printed in this Journal.

It has been proved that double dipping with an interval of not more than 14 days between the dippings is a necessary measure to secure the eradication of Sheep Scab, and that when proper precautions are taken such dipping can be carried out with little risk even when poisonous dips are used for each dipping. All risk, however, can be avoided by the use of non-poisonous dips, of which the lime and sulphur dip (see footnote as to Ingredients, etc.), is considered the best for the cure of Scab.

I am, therefore, to suggest to your Local Authority that when double dipping with an interval of not more than 14 days between the two dippings is prescribed, either by an Order of the Board or by a Notice issued under any Order of the Board, the owner or owners concerned should be warned that it is always safer to use non-poisonous dips, and if they elect to use a poisonous dip for the purposes of the first dipping it is highly advisable that for the purposes of the second dipping a non-poisonous dip should be used. There are, of course, many non-poisonous dips on the market which have been approved by the Board for the purposes of their Orders relating to Sheep Scab and Sheep Dipping.

I am, etc.,

(Signed) A. D. HALL.

Prescription for Lime and Sulphur Dip.

Ingredients.—Lime, powdered sulphur and water in the proportions indicated above.

A convenient quantity for a large establishment to make up at a time would be 9 lb. lime and 18 lb. sulphur.

Method of Preparation.—Slake the lime and make into a thick paste with the sulphur. Place the mixture in a strong cloth, tie the ends and suspend in a boiler containing 10 gal. of water so that the water completely covers the contents of the cloth. The cloth must not touch the sides or bottom of the boiler, as otherwise the cloth may be burned and its contents escape. Boil for two hours, then remove the cloth, taking care that none of its contents escape into the water, and throw the solids away. Make up to 10 gal. again with additional water, and put the liquid into a tight drum or barrel. This quantity is sufficient when mixed with water to make 100 gal. of dipping bath. The period of immersion in this dip should not be less than half a minute.

SINCE the Note was published in the issue of this *Journal* for last month, summarising the position as regards Foot-and-Mouth Disease in Great Britain, all the remaining general restrictions have been withdrawn from the Surrey and ten Isle of Wight Scheduled Districts, no outbreaks of the disease having occurred therein since 12th and 24th November respectively. In Warwickshire a small area still remains subject to a Prohibition Movement Order on account of the outbreak of the disease near Rugby on 15th December. Outbreaks have unfortunately appeared in six fresh centres during the past four weeks, and the position as regards each centre, and of the Durham outbreak notified last month, is as follows:—

Foot-and-Mouth Disease.

Durham.—Further outbreaks on premises about 5 miles from the original centre were confirmed on 3rd January at Sherburn Hill and Shadforth, and on 7th January at Shadforth. These three cases were connected. The restrictions on movement and marketing of stock have been modified as regards a large part of the Scheduled District, but no movement out of the district is permitted.

West Sussex.—An outbreak was confirmed at Harting on 22nd September, and the usual Order entirely prohibiting movement within a radius of about 15 miles was made. There has fortunately been no extension of the disease in this locality, and the general restrictions have been modified.

Yorkshire (West Riding) (Sheffield District).—An outbreak was confirmed at Bradfield on 23rd December, and an Order was at once made prohibiting movement in a large area around the Infected Place. There has been no further case and the restrictions have been modified.

East Kent.—An outbreak was confirmed at Alkham, near Dover, on 27th December, and another at Cheriton, Folkestone, on 28th December. Since the later date five further outbreaks have been confirmed in the same locality, the latest being on 10th January. Prohibition of movement of animals is being maintained in a substantial area around Dover and Folkestone, but the restrictions have been modified as regards the remainder of the Scheduled District.

Hampshire, Dorset, Essex.—Outbreaks were confirmed at Boldre, near Lymington, Hampshire, on 9th January, and at West Morden, Dorset, and Great Waltham, Essex, on 10th January. Orders were at once made prohibiting movement of animals in a large area in the localities affected.

ONLY one case of Rabies has been confirmed in Great Britain since the Note in the December issue of this *Journal* was written. This was at Hythe, Kent, on 5th January. The unmuzzling areas in (a) Monmouthshire and South Wales, and (b) North Essex and Suffolk, have been substantially reduced.

IN connection with the Royal National Eisteddfod of Wales, to be held at Barry in August, 1920, the Executive Committee announce that a competition has been arranged for the best essay on each of two subjects dealing with agriculture. The titles of the subjects, the prizes to be awarded, and the names of the adjudicators, are as follows:—

**Essays on Agriculture
for the National
Eisteddfod of Wales,
1920.**

1. Account of a series of experiments on the relative values of the nitrogenous manures (in connection with other manures) for cropping in agriculture £5

Adjudicator.—Abel E. Jones, Esq., B.Sc., N.D.A., N.D.D., Aberystwyth.

2. Account of the cropping of a small holding of from 2 to 3 acres, giving the initial capital required, annual expenditure, and possible returns for the first 3 years, supposing the holding was
(a) on cultivated land. } £10
(b) on old pasture. }

Adjudicator.—George P. Berry, Esq., Horticultural Division, Ministry of Agriculture and Fisheries, London.

For further particulars as to the general rules and conditions of the competition, application should be made to Mr. D. W. Walters, B.Sc., 15, Wenloe Terrace, Barry, Glam. An addressed envelope should be enclosed with the application.

September, 1919, p. 650.—In line 7 of the Note "Winter Milk Prices in Great Britain" the figure under "February" should read 3s. 3d. instead of 3s., and under "March" 3s. "Journal" Errata. instead of 3s. 3d.

December, 1919, p. 940.—In line 26, for "Netherhampton, in Hampshire," read "Netherhampton, in Wiltshire."

NOTICES OF BOOKS.

Cottage Buildings in Cob, Pisé, Chalk and Clay.—C. Williams-Ellis (London: Offices of "Country Life," 1919, 6s. net). This book is a new and valuable addition to the "Country Life Library." Its publication indicates an increased interest in the whole question of building material. The needs of the housing problem are proving to be an incentive to research and inquiry into every method of construction. When the material used by our ancestors in the construction of their mud-huts is shown to be, if scientifically used, good building material for our houses to-day, one is inclined to believe the truth of the saying that "there is no new thing under the sun."

This book should be read before walls of earth are condemned; it would then be understood that certain methods of building have been so long neglected that to inquire into and revive their use almost amount to something novel. Many of these ancient methods were thoroughly practical.

Construction in cob, chalk and clay lump has in the past been employed in countless small buildings throughout England, and the fact that such buildings are still standing four square to the winds testifies to the usefulness and the durability of the material. The book contains much valuable information and good illustrations of buildings of these materials, but the really interesting chapters are those dealing with pisé or rammed earth used for building walls. This method of building has been little employed in this country, though it has been used most successfully in parts of France and Australia. The material, being the native earth dug from the site, has the same advantage of cheapness as is possessed by the cob of Devonshire. There is no expense for purchase and transport, but it is considered superior to cob.

Mr. St. Loe Strachey has been mainly instrumental in introducing this kind of building into this country, and his enthusiasm refused to be damped by those who prophesied evil. He persisted in his experiments, and has gone far enough to prove that pisé is an eminently practical form of walling for modern-day use in small buildings. He has written a racy preface to the book telling how he came to make his experiment and what he has achieved. Mr. Williams-Ellis supplements this in the body of the book, with reports from other sources and some practical hints on the construction of the shuttering that is essential for the hard ramming of the earth, and tells us what kind of earth is required for success.

Pisé buildings would seem to go some way to solve the housing problem of the present day, at any rate for rural houses. The material offers a method of building walls without bricks and without skilled labour, sound in every sense.

The "Country Life" Book of Cottages.—Lawrence Weaver (London: Offices of "Country Life," 1919, 9s. 6d. net). This book was first published in March, 1913, and was then extensively reviewed. In this new edition many chapters have been wholly rewritten and furnished with fresh illustrations, showing the most recent types of cottages, especially those for the housing of the agricultural labourer.

National Year-book of Agricultural Legislation, 1918.—The International Institute of Agriculture has recently issued its eighth International Year-book of agricultural legislation. The volume contains an introduction in English, in which the general course of the legislation of the world in 1918 in connection with agriculture is outlined, principally as affected by the conditions created by the later phases of the War, and by the reconstruction movement which has followed.

The price of the volume is 11s. 11d. Remittances should be forwarded to the Secretary, Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1.

MISCELLANEOUS NOTES.

THE *International Crop Report and Agricultural Statistics* for December, 1919, published by the International Institute of Agriculture, gives particulars concerning the production of the cereal crops of 1919 in certain countries in the Northern Hemisphere.

Notes on Crop Prospects and Live Stock Abroad.

Wheat.—The production in Denmark, Spain, France, Great Britain, Italy, Netherlands, Rumania, Switzerland, Canada, United States, British India, Japan, Algeria, and Tunis is estimated at 259,270,000 qr. in 1919, against 279,700,000 qr. in 1918, or a decrease of 7·3 per cent., the area sown showing an increase of 0·5 per cent.

Rye.—The estimated production in Denmark, Spain, France, Italy, Netherlands, Rumania, Switzerland, Canada, and the United States is placed at 22,056,000 qr. in 1919, or a decrease of 1·2 per cent. compared with 1918, when it amounted to 22,334,000 qr., but the area sown shows an increase of 6·9 per cent.

Barley.—The production in Denmark, Spain, France, Great Britain, Italy, Netherlands, Rumania, Switzerland, Canada, United States, Japan, Algeria, and Tunis is estimated to amount to 72,044,000 qr. in 1919, against 84,620,000 qr. in 1918, or a decrease of 14·9 per cent., the area sown being smaller by 6·0 per cent.

Oats.—It is estimated that the total yield in Denmark, Spain, France, Great Britain, Italy, Netherlands, Rumania, Switzerland, Canada, United States, Japan, Algeria, and Tunis amounts to 221,626,000 qr. in 1919, against 261,632,000 qr. in 1918, or a decrease of 15·3 per cent., the area sown being smaller by 1·9 per cent.

Maize.—The production in Spain, Italy, Rumania, Switzerland, Canada, and the United States is estimated at 364,817,000 qr. in 1919, against 317,614,000 qr. in 1918, or an increase of 14·9 per cent., while the area sown shows a decrease of 3·3 per cent.

Finland.—H.M. Minister at Helsingfors reports that the production of cereals in Finland, in 1919, is estimated by the Finnish Board of Agriculture as follows:—Rye, 1,454,000 qr.; barley, 743,000 qr.; and oats, 3,031,000 qr. The quantities required for consumption in Finland are estimated to be:—Rye, 2,827,000 qr.; barley, 531,000 qr.; and oats, 2,538,000 qr.

New Zealand.—The area under wheat this year in New Zealand is officially estimated at 142,000 acres, compared with 210,000 acres seeded last year. The area under oats is estimated at 410,000 acres, against 487,000 acres last year (*Broomhall's Corn Trade News*, 31st December, 1919.)

Live Stock in Canada.—The numbers of live stock in 1919 were as follows (the corresponding numbers in 1918 being shown in brackets):—Horses, 3,667,369 (3,609,257); dairy cows, 3,547,437 (3,543,600); other cattle, 6,536,574 (6,507,267); sheep, 3,421,958 (3,052,748); pigs, 4,040,070 (4,289,682). (*International Crop Report and Agricultural Statistics*, December, 1919.)

THE monthly crop report of the Board on 1st January was as follows:—The weather of December was everywhere mild and wet, with the result that little progress with the further seeding of the land could, as a rule, be made. As the preceding months

Agricultural Conditions in England and Wales on 1st January. had been favourable to cultivation, however, work is practically everywhere forward for the time of year. The young crops, where showing, are generally satisfactory, with the exception of some wheat on low-lying land,

which has suffered a little from the wet. As compared with the same period a year ago, it is estimated that the area at present sown with wheat is slightly smaller; while it is reckoned that one-fifth of the ultimate wheat area yet remains to be seeded.

In nearly all districts many fields of seeds are patchy and thin, but reports of even and promising plants are more common, and on the whole the position is fairly satisfactory, an improvement being very generally reported.

Turnips and swedes, though a small crop, are generally sound and of good quality.

The condition of ewes is fairly satisfactory; and lambing prospects in the earliest districts are regarded as favourable. Owing to the scarcity of winter keep, especially hay and roots, stock are being fed more sparingly than usual, and in many districts are somewhat lean in consequence. Many cattle are still out at grass.

Unskilled labour is generally sufficient, but skilled men on the other hand are scarce in all districts.

The following local summaries give details regarding agricultural labour in the different districts of England and Wales in December:—

Agricultural Labour in England and Wales during December. *Northumberland, Durham, Cumberland, and Westmorland.*—The supply of labour is now sufficient as a rule, though in one or two districts there is not enough temporary labour for turnip-lifting, and skilled labour is occasionally scarce.

Lancashire and Cheshire.—The supply of labour is sufficient in most districts, but in some there is a scarcity of skilled men.

Yorkshire.—The supply of labour is sufficient, but skilled men are still scarce.

Shropshire and Stafford.—The supply of labour is, in general, adequate, but in many districts more skilled men are needed.

Derby, Nottingham, Leicester, and Rutland.—In most districts there is a shortage of experienced and skilled men; the supply of unskilled labour appears to be sufficient.

Lincoln and Norfolk.—The supply of ordinary labour is about sufficient, but there are still complaints of a shortage of skilled men, such as horsemen and cattlemen.

Suffolk, Cambridge, and Huntingdon.—As a rule the supply of labour is sufficient, but in many parts of Cambridge and Huntingdon skilled men are wanted.

Bedford, Northampton, and Warwick.—Though skilled men are scarce, there is sufficient labour available.

Buckingham, Oxford, and Berkshire.—The supply of labour is sufficient to meet present requirements, but skilled men are still in demand.

Worcester, Hereford, and Gloucester.—There is sufficient labour available, though skilled men are scarce in some districts.

Cornwall, Devon, and Somerset.—The supply of labour is sufficient for present requirements, as a rule, but there are local shortages of skilled men.

Dorset, Wiltshire, and Hampshire.—The supply of labour is generally quite sufficient for this season of the year. Unskilled labour is abundant, but there is a shortage of skilled thatchers, hedgers, and ditchers.

Surrey, Kent, and Sussex.—The supply of labour is, as a rule, sufficient, but in many districts more skilled men are wanted.

Essex, Hertford, and Middlesex.—The supply of labour is sufficient generally, but in Essex skilled men are still needed.

North Wales.—The supply of labour is, as a rule, sufficient, but there is still a demand for skilled men in some districts.

Mid Wales.—The supply of labour is now sufficient for requirements in most districts.

South Wales.—The supply of labour is, on the whole, adequate, though there are still local shortages, especially of skilled men.

SEPTENNIAL, QUARTERLY AND ANNUAL CORN RETURNS.

STATEMENT showing what has been, during seven years, ending Christmas Day, 1919, the average price of an Imperial bushel of British wheat, barley, and oats, computed from the weekly averages of Corn Returns, pursuant to the Corn Returns Act, 1882.

Wheat.	Barley.	Oats.
s. d. 7 1½	s. d. 6 1½	s. d. 4 6½

Board of Agriculture and Fisheries,

5th January, 1920.

R. J. THOMPSON.

NOTE.—The value of £100 Tithe Rent-charge for the year 1920, as fixed by the Tithe Act, 1918, will be £109 3s. 11d.

STATEMENT showing the average price of British corn, per quarter (Imperial measure) for the quarter ending Christmas, 1919, pursuant to the Corn Returns Act, 1882.

Wheat.	Barley.	Oats.
s. d. 7s 8	s. d. 10s 2	s. d. 5s 7

Board of Agriculture and Fisheries,

5th January, 1920.

R. J. THOMPSON

STATEMENT showing the average price of an Imperial bushel of British corn, for the year ending Christmas, 1919, pursuant to the Corn Returns Act, 1882.

Wheat.	Barley.	Oats.
s. d. 9 1½	s. d. 9 5½	s. d. 6 6½

Board of Agriculture and Fisheries,

5th January, 1920.

R. J. THOMPSON.

COMPARATIVE STATEMENT, for the years 1913 to 1919, of the quantities sold and the average prices per quarter (Imperial measure) of British corn as returned under the Corn Returns Act, 1882.

Year.	Quantities sold.			Average Price.		
	Wheat.	Barley.	Oats.	Wheat.	Barley.	Oats.
	Qr.	Qr.	Qr.	s. d.	s. d.	s. d.
1913	2,511,297	2,948,930	639,298	31 8	27 3	19 1
1914	3,027,976	3,403,072	1,164,361	34 11	27 2	20 11
1915	3,225,198	2,552,128	1,181,480	32 10	37 4	30 2
1916	3,600,391	2,182,218	1,129,096	58 5	53 6	33 5
1917	2,386,196	2,416,966	823,072	75 9	64 9	49 10
1918	2,484,210	1,870,761	448,313	72 10	59 0	49 4
1919	3,045,129	3,112,858	675,998	72 11	75 9	52 5

Board of Agriculture and Fisheries,

5th, January, 1920.

R. J. THOMPSON.

AVERAGE PRICES of British Wheat, Barley, and Oats at certain Markets during the Month of December, 1917, 1918, and 1919.

	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919	1917.	1918.	1919.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	72 1	73 1	72 10	59 0	63 2	109 2	47 2	64 6	61 11
Norwich ...	70 10	72 5	72 6	57 9	62 10	108 1	43 0	58 9	58 9
Peterborough	70 9	72 1	72 6	58 7	62 4	102 5	42 4	46 1	58 11
Lincoln ...	70 10	72 0	72 3	58 5	62 4	107 5	43 0	56 8	58 10
Doncaster ...	70 11	71 11	72 8	58 3	60 9	104 7	41 9	—	57 4
Salisbury ...	70 2	71 10	72 2	58 10	62 10	103 11	41 10	51 7	54 7

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1917, 1918 and 1919.

Weeks ended (in 1919).	WHEAT.			BARLEY.			OATS.		
	1917.	1918.	1919.	1917.	1918.	1919.	1917.	1918.	1919.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Jan. 4 ...	76 0	71 2	72 2	66 4	58 0	62 3	47 1	45 5	48 8
" 11 ...	75 8	71 2	72 6	65 7	58 2	62 5	47 2	46 9	49 8
" 18 ...	75 8	71 3	72 7	64 9	58 1	62 3	47 4	47 9	50 0
" 25 ...	75 10	71 1	72 7	64 5	58 7	61 10	47 8	48 2	49 6
Feb. 1 ...	75 10	71 2	72 8	64 0	58 10	62 4	47 3	50 2	49 7
" 8 ...	76 0	72 0	72 7	63 5	59 0	62 3	46 11	50 6	49 2
" 15 ...	76 3	72 3	72 8	63 8	58 11	62 5	47 3	52 0	49 0
" 22 ...	76 9	72 2	72 8	63 9	58 9	62 6	47 8	52 3	49 4
Mar. 1 ...	77 4	72 2	72 7	64 0	57 9	62 7	48 0	52 0	48 8
" 8 ...	78 0	72 3	72 6	63 7	58 5	62 7	48 7	52 2	48 6
" 15 ...	78 10	72 4	72 5	64 1	56 10	62 5	49 4	51 0	46 8
" 22 ...	80 3	72 3	72 7	65 6	56 9	62 1	50 4	50 3	46 4
" 29 ...	81 5	72 4	72 7	71 10	56 7	62 8	51 10	48 10	46 11
Apr. 5 ...	84 4	72 11	72 6	69 11	56 7	62 8	55 1	49 10	47 2
" 12 ...	85 2	73 3	73 0	71 10	56 6	62 9	57 2	47 2	47 1
" 19 ...	84 10	73 3	73 1	70 6	56 6	62 9	59 8	47 0	47 3
" 26 ...	81 1	73 3	73 1	69 5	56 10	62 9	58 6	46 8	48 1
May 3 ...	77 7	73 5	73 2	64 4	56 5	62 8	54 9	47 4	48 7
" 10 ...	78 0	73 5	73 2	64 11	56 6	63 1	55 2	47 6	47 5
" 17 ...	77 11	73 4	73 3	64 10	56 6	62 4	55 2	46 4	47 11
" 24 ...	78 0	73 3	73 2	64 9	56 6	62 7	54 11	47 8	47 11
" 31 ...	78 0	73 8	73 3	65 11	60 0	62 7	54 11	44 9	48 3
June 7 ...	78 0	73 11	73 2	67 7	59 2	62 6	55 0	45 5	47 10
" 14 ...	78 2	74 3	73 3	75 6	57 9	62 8	55 1	45 7	48 11
" 21 ...	78 1	74 4	73 3	75 0	58 5	62 8	55 2	47 8	48 7
" 28 ...	78 3	74 4	73 3	73 11	57 10	63 4	55 1	46 4	49 1
July 5 ...	78 1	74 4	73 4	69 5	61 7	62 4	55 2	46 10	49 0
" 12 ...	78 2	74 4	73 3	70 10	57 5	63 1	55 1	47 0	49 11
" 19 ...	78 3	74 3	73 4	72 1	60 5	62 9	55 2	45 4	49 11
" 26 ...	78 3	74 3	73 4	65 7	56 11	63 4	55 2	46 2	48 11
Aug. 2 ...	78 2	74 3	73 3	73 6	57 1	62 10	55 0	45 10	50 3
" 9 ...	78 4	74 7	73 4	76 1	57 7	73 8	55 0	46 3	55 6
" 16 ...	78 7	74 2	73 3	68 11	61 4	75 2	55 6	55 11	61 4
" 23 ...	76 7	74 8	73 10	70 7	62 6	83 4	54 7	56 9	62 0
" 30 ...	72 1	74 8	73 3	60 4	60 1	86 7	49 0	57 11	61 10
Sept. 6 ...	71 6	72 3	73 4	59 3	60 4	89 3	46 7	56 9	61 1
" 13 ...	70 7	72 5	73 5	57 2	60 1	92 5	45 0	49 2	62 4
" 20 ...	70 8	72 6	73 4	56 10	60 4	94 7	45 8	49 11	61 3
" 27 ...	70 6	72 7	73 0	58 5	60 3	95 2	44 7	50 3	60 2
Oct. 4 ...	70 8	72 8	73 4	57 9	60 3	94 4	44 9	50 9	59 6
" 11 ...	71 0	72 6	73 1	58 5	60 3	95 5	44 5	51 6	58 10
" 18 ...	70 8	72 7	73 0	59 3	60 3	93 10	44 1	50 9	57 9
" 25 ...	70 10	72 5	73 0	60 1	60 3	95 1	43 0	50 5	57 5
Nov. 1 ...	70 4	72 4	72 9	59 11	60 3	96 0	42 4	50 8	56 4
" 8 ...	70 3	72 4	72 8	60 2	60 3	97 10	42 11	49 11	55 3
" 15 ...	70 3	72 5	72 7	60 2	60 3	100 7	43 0	49 10	55 7
" 22 ...	70 2	72 4	72 7	59 9	60 10	104 11	43 1	51 1	55 11
" 29 ...	70 2	72 3	72 7	59 3	62 2	107 9	44 6	50 4	56 0
Dec. 6 ...	70 7	72 4	72 7	58 7	62 6	108 11	43 5	51 4	55 10
" 13 ...	71 2	72 3	72 6	58 0	62 7	105 2	43 6	51 4	56 9
" 20 ...	71 1	72 4	72 6	57 7	62 3	103 6	44 2	50 5	56 3
" 27 ...	71 1	72 3	72 6	57 7	62 3	105 10	44 10	50 6	57 2

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in December and November, 1919.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	DECEMBER.		NOVEMBER.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.
FAT STOCK:—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Cattle:—				
Polled Scots	83 1	77 3	79 6	74 4
Herefords	82 5	77 4	79 3	74 3
Shorthorns	82 5	77 4	79 1	74 2
Devons	82 1	77 1	79 0	74 1
Welsh Runts... ..	80 11	76 8	78 8	74 10
Fat Cows	77 4	69 3	74 1	66 4
	First Quality. per lb.*	Second Quality. per lb.*	First Quality. per lb.*	Second Quality. per lb.*
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
Veal Calves	17½	15	16	14
Sheep:—				
Downs	15½	15½	14½	14½
Longwools	15½	15½	14½	14½
Cheviots	15½	15½	14½	14½
Blackfaced	15½	15½	14½	14½
Welsh... ..	15½	15½	14½	14½
Cross-breds	15½	15½	14½	14½
	per score. live weight.	per score. live weight.	per score. live weight.	per score. live weight.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Pigs:—				
Bacon Pigs	23 0	23 0	21 0	21 0
Porkers	23 0	23 0	21 0	21 0
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>
Shorthorns—In Milk ...	58 17	44 2	56 16	42 18
" —Calvers ...	53 1	39 13	52 12	39 0
Other Breeds—In Milk ...	—	—	—	—
" —Calvers ...	—	—	—	—
Calves for Rearing	4 3	3 0	3 17	2 17
Store Cattle:—				
Shorthorns—Yearlings ...	15 1	12 4	15 3	12 2
" —Two-year-olds	26 18	21 12	27 1	21 11
" —Three-year-olds	37 9	33 4	37 7	32 3
Herefords—Two-year-olds	29 16	23 17	28 19	24 15
Devons—	27 8	22 16	27 18	23 9
Welsh Runts—	25 10	20 10	27 7	20 13
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Downs or Longwools ...	73 9	56 11	63 3	50 9
Store Pigs:—				
8 to 12 weeks old	47 0	33 10	44 8	32 3
12 to 16 " 	92 10	72 11	90 9	70 11

* Estimated carcass weight.

NOTE.—The prices per lb. for sheep do not include the value of the skins, which during December made prices equivalent to an additional $\frac{1}{2}$ d. per lb. of the carcass weight for Downs, $\frac{3}{4}$ d. for Longwools, Cheviots, Blackfaced and Crossbreds, and $\frac{1}{2}$ d. for Welsh, and during November, $\frac{1}{2}$ d. per lb. for Downs and Welsh and $\frac{1}{4}$ d. for Longwools, Cheviots, Blackfaced and Crossbreds.

**AVERAGE PRICES of PROVISIONS, POTATOES and HAY at
certain MARKETS in ENGLAND in December, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	—	—	—	—	—	—
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
„ Factory	—	—	—	—	—	—
Imported (Controlled)	252 0	—	252 0	—	252 0	—
CHEESE—						
British—						
Cheddar	157 0	—	—	—	157 0	—
Cheshire	—	—	120 lb. 168 6	—	120 lb. 168 6	—
Canadian	149 6	—	per cwt. 149 6	—	per cwt. 149 6	—
BACON :—						
Irish (Green)	202 6	—	202 6	—	202 6	—
Canadian (Green sides)	192 0	—	192 0	—	192 0	—
HAMS :—						
York (Dried or Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green) (long cut)	195 0	—	195 0	—	195 0	—
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	50 0	—
Canadian	—	—	37 6	36 5	40 0	38 0
American	36 2	33 0	33 11	31 7	35 2	33 2
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Arran Chief	240 0	206 0	—	—	260 0	240 0
Edward VII.	276 0	257 0	253 0	243 6	270 0	250 0
Other Late Varieties...	260 0	240 0	201 6	178 6	260 0	240 0
HAY :—						
Clover	—	—	—	—	309 0	284 0
Meadow	—	—	—	—	300 0	280 0

**AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in December, 1919.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	Quality.	Birming- ham.	Leeds.	London.	Man- chester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—					
English	1st	140 0	140 0	140 0	140 0
	2nd	140 0	140 0	140 0	140 0
Cow and Bull	1st	140 0	140 0	140 0	140 0
	2nd	140 0	140 0	121 6	121 6
Irish : Port Killed	1st	—	—	140 0	—
	2nd	—	—	140 0	—
Argentine Frozen—					
Hind Quarters	1st	126 0	126 0	126 0	126 0
Fore „	1st	98 0	98 0	98 0	98 0
Australian Frozen—					
Hind Quarters	1st	126 0	—	126 0	126 0
Fore „	1st	98 0	—	98 0	98 0
New Zealand Frozen—					
Hind Quarters	1st	—	—	126 0	126 0
Fore „	1st	—	—	98 0	98 0
VEAL :—					
British	1st	98 0	98 0	98 0	98 0
	2nd	—	98 0	98 0	98 0
MUTTON :—					
Scotch	1st	147 0	147 0	147 0	147 0
	2nd	147 0	147 0	147 0	147 0
English	1st	147 0	147 0	147 0	147 0
	2nd	147 0	147 0	147 0	147 0
Irish : Port Killed	1st	—	—	—	—
	2nd	—	—	—	—
Argentine Frozen	1st	98 0	98 0	98 0	98 0
New Zealand „	1st	—	—	98 0	98 0
Australian „	1st	—	—	98 0	98 0
LAMB :—					
British	1st	—	—	—	—
	2nd	—	—	—	—
New Zealand	1st	98 0	—	98 0	98 0
Australian	1st	—	—	98 0	98 0
Argentine	1st	98 0	98 0	98 0	—
PORK :—					
British	1st	—	—	163 6	149 6
	2nd	—	—	—	—
Frozen	1st	—	—	133 0	—

DISEASES OF ANIMALS ACTS 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	DECEMBER.		TWELVE MONTHS ENDED DECEMBER.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	22	22	234	245
Animals attacked	34	24	14	282
Foot-and-Mouth Disease :—				
Outbreaks	5	—	75	3
Animals slaughtered as diseased or exposed to infection ...	371	—	3,437	40
Glanders (including Farcy) :—				
Outbreaks	3	3	25	34
Animals attacked	3	6	61	98
Parasitic Mange :—				
Outbreaks	422	472	5,015	4,483
Animals attacked	729	967	9,861	8,422
Rabies :—				
Number of cases	2	22	155	168
„ „ Dogs affected	2	15	150	98
„ „ other animals affected	—	7	5	10
Sheep-scab :—				
Outbreaks	117	48	438	352
Swine Fever :—				
Outbreaks	146	107	2,305	1,407
Swine slaughtered as diseased or exposed to infection ...	43	36	1,039	562

IRELAND.*(From the Returns of the Department of Agriculture and Technical
Instruction for Ireland.)*

DISEASE.	DECEMBER.		TWELVE MONTHS ENDED DECEMBER.	
	1919.	1918.	1919.	1918.
Anthrax :—				
Outbreaks	—	—	—	2
Animals attacked	—	—	—	2
Glanders (including Farcy) :—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Parasitic Mange :—				
Outbreaks	5	3	140	98
Sheep-scab :—				
Outbreaks	41	56	298	352
Swine Fever :—				
Outbreaks	3	8	34	36
Swine slaughtered as diseased or exposed to infection ...	10	9	106	138

The Weather in England during December.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
<i>Week ending 6th Dec.:</i>								
England, N.E. ...	40·6	+0·5	0·44	11	— 6	6	1·4	+0·1
England, E. ...	42·3	+1·8	1·79	45	+29	7	1·4	—0·0
Midland Counties ...	42·1	+2·1	1·33	34	+16	7	1·2	—0·1
England, S.E. ...	43·8	+1·6	2·05	52	+28	7	1·5	—0·0
England, N.W. ...	42·8	+1·2	1·07	27	+1	7	0·8	—0·3
England, S.W. ...	45·0	+1·4	2·73	69	+33	7	1·4	—0·2
English Channel ...	48·3	+1·2	1·54	39	+6	6	1·4	—0·4
<i>Week ending 13th Dec.:</i>								
England, N.E. ...	37·6	—2·3	0·38	10	— 3	5	1·5	+0·2
England, E. ...	37·2	—3·0	0·37	9	— 6	4	1·5	+0·2
Midland Counties ...	39·0	—0·7	0·20	5	—13	3	1·7	+0·5
England, S.E. ...	39·3	—2·7	0·23	6	—13	3	1·6	+0·1
England, N.W. ...	40·6	—0·5	0·38	9	—14	3	2·2	+1·2
England, S.W. ...	42·3	—0·9	0·84	21	—10	5	2·7	+1·3
English Channel ...	44·6	—2·1	0·34	9	—17	5	2·6	+0·8
<i>Week ending 20th Dec.:</i>								
England, N.E. ...	41·3	+2·5	0·87	22	+11	5	0·6	—0·5
England, E. ...	40·8	+1·9	0·35	9	—0·0	6	0·4	—1·0
Midland Counties ...	42·0	+3·4	0·76	19	+8	5	0·6	—0·5
England, S.E. ...	43·0	+2·5	0·62	16	+3	5	0·6	—0·9
England, N.W. ...	43·5	+3·2	1·30	33	+16	6	0·7	—0·3
England, S.W. ...	44·8	+2·5	0·99	25	+3	6	1·0	—0·4
English Channel ...	47·3	+1·6	0·55	14	—3	6	0·7	—1·0
<i>Week ending 27th Dec.</i>								
England, N.E. ...	38·6	0·0	0·70	18	+7	5	1·2	+0·1
England, E. ...	41·1	+2·8	0·90	23	+11	6	1·2	+0·1
Midland Counties ...	41·8	+3·4	1·14	29	+14	6	1·2	+0·2
England, S.E. ...	43·8	+3·6	0·94	24	+8	6	0·9	—0·3
England, N.W. ...	41·7	+1·8	1·83	46	+27	6	0·9	—0·1
England, S.W. ...	45·0	+3·0	1·48	37	+10	7	1·0	—0·1
English Channel ...	48·0	+2·7	1·47	37	+14	7	1·4	—0·3

* 1 inch = 25·4 millimetres.

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NOTES.

LORD LEE OF FAREHAM, Minister of Agriculture and Fisheries, addressing representatives of agricultural education on the 15th January last, in the Hall of the Civil Engineers' Institute, outlined proposals for the extension of agricultural education and research throughout the country.

**Agricultural
Education and
Research.**

In view of our limited area of land, the increased production of foodstuffs on which our future security depends can only be obtained by far more intensive cultivation. This involves a great increase of understanding of modern agriculture, and a far wider spread of agricultural education. In educational affairs, as in all other matters connected with agricultural progress, the motto of the Ministry is "Trust the Counties." In the main, the Ministry will confine its responsibilities to co-ordinating the efforts of the Local Authorities, giving them every assistance it can. It will become the source from which central technical advice on agricultural matters will issue. After explaining the organisation of the Intelligence Department recently set up at the Ministry under the control of Sir Daniel Hall, K.C.B., F.R.S., Lord Lee touched on the question of the local organisation for providing agricultural education and advice. The immediate question which arises out of the Ministry of Agriculture and Fisheries Act, 1919, is this: Is agricultural education to be entrusted to the Education Committee of the County Council, or transferred to the Agricultural Committee? The Act gives the option to each county to exercise its discretion, and the Ministry does not intend to use its influence on one side or the other. If agricultural education goes over to the Agricultural Committee, the Ministry is in complete agreement with the Board of Education in wishing to see an adequate representation of the main Education

Committee on the Sub-Committee which would doubtless be set up by the Agricultural Committee to deal with agricultural education.

The Minister emphasised the importance of securing the best men for the work and of fixing salaries commensurate with the services required of them, since, however urgent the need for economy, inefficiency is dear at any price. He stated that forty-two counties had already appointed Agricultural Organisers, and he hoped that the delay in the remaining counties was due solely to the difficulty of finding the very best men for the posts.

In addition to the Organiser and the Horticultural Superintendent in such counties as possess a considerable development of horticulture, the appointment of specialist instructors in dairying and poultry-keeping is recommended, and perhaps a still larger staff will be needed, but the Ministry does not propose to hamper the Councils and will leave local conditions to decide local requirements. Farmers requiring advice should apply in the first instance to their County Agricultural Organiser, who will turn if necessary to the advisers attached to the provincial Agricultural College. If the College staff cannot deal with the question, it will be referred to the Ministry, which will call in such expert opinion as may be necessary. Farm Institutes, defined in general terms as agricultural schools, providing courses in agriculture for the sons of farmers, together with summer and other special courses for women and others, are regarded as of great importance to counties, but in view of the building difficulties Councils will be well advised to lease rather than to buy land for such Institutes and to adapt existing buildings rather than seek to erect new ones. The chief object of the Ministry is to give a general stimulus to educational effort and to ensure that the educational work is carried on in close touch with the other activities of the County Agricultural Committees, such as land settlement and the improvement of cultivation.

* * * * *

In the middle of January a Conference of Agricultural Organisers and Principals of Agricultural Colleges and Research Institutions was held at the Ministry of Agriculture to consider the Ministry's scheme for the improvement of grass land. Sir Daniel Hall, K.C.B., F.R.S., in an opening address, outlined proposals and explained how enormously the produce of grass land would be increased by the aid of a little knowledge and

**The Improvement of
Grass Land.**

expenditure. He went on to say that the time was considered ripe for a wide extension of demonstration work and for a campaign of enlightenment among farmers. It is proposed to establish grass plots as far and wide as possible, preferably by the road-side. Demonstrations will so be carried on that the most casual passer can see, almost at a glance, the improvements that a little skill and care may bring about. Professor Somerville of Oxford, and Professor Stapledon of Aberystwyth, two of our greatest authorities on grass land improvement, will deliver a series of lectures in different parts of the country and will place their knowledge at the disposal not only of the Ministry, but of all Local Authorities throughout the country. The trials to be carried out will be regulated by the conditions that obtain in each county, and the work will be left in the hands of the County and College Authorities. Dr. Somerville, who followed Sir Daniel Hall in addressing the Conference, stated that after nearly thirty years' work on grass land improvement he had come to the conclusion that there was no form of experiment and expenditure likely to bring about such important results. He reminded the audience that we have in this country at present over sixteen million acres of grass land, by far the greater part of which can be very considerably improved. The plans as outlined met with general approval, a scheme of demonstration and experiment was considered, and the details have since been published (see p. 1133).

* * * * *

A Rural Industries Branch has been established at the Ministry of Agriculture for the purpose of propaganda and for developing organisation in connection with

**The Growth of
Rural Industries.**

the keeping of pigs, poultry, goats, rabbits and bees, and the preservation of fruit and vegetables. The Branch will also deal with schemes for the development of Rural Industries and social life in rural places and for the co-ordination of action by Local Authorities and other bodies by which such development may be effected. The establishment of this Branch, which has been placed in charge of Sir John Green, late of the Rural League, marks a definite effort on the part of the Ministry to give a measure of permanence to conditions that arose during the War, when the submarine campaign became so great a menace that it was necessary to stimulate production, not only on the large farms, but on the smallest of small holdings and allotments. In the opinion of those best qualified to judge, the agricultural labourer and other dwellers in rural areas will have better

opportunities in the future than they have enjoyed in the past for keeping live stock and developing home production. At a time when the Village Clubs Association and the Women's Institutes and other social forces are stimulating life in the countryside, the villager finds himself in the possession of a higher wage and larger leisure than he has ever known; it follows that he may be expected to take an active interest in the improvement of his own position.

* * * * *

ONE of the most encouraging results of the National Rat Week in this country is the interest aroused abroad. Inquiries have come from the authorities in many far-away lands—from Mesopotamia, from Accra on the Gold Coast, from Shanghai, from New Zealand, and from Nigeria, India, and the West Indies. The authorities have written to the Board to inquire precisely what is being done to abate the rat menace, asking for literature and for the results of experiments with various poisons, stating the special needs of their own country and asking how these can best be met. Inasmuch as the rat menace is universal in its scope, and is most deadly in some of those parts of the world that are under British control, it is indeed encouraging to find that the handling of the problem in the Mother Country has stimulated so much interest and inquiry elsewhere. It is unnecessary, perhaps, to say that all possible information has been sent and that a careful record of all experiments that are possible under the existing conditions is being kept and will be published in due course. It may be mentioned that inquiries have not been limited to Africa, Asia and Australasia. Both the Swiss and the Danish authorities are keenly interested in all that is being done. These countries have been active in the past and are busy to-day in doing what they can to destroy their rats. It may be hoped that facilities for scientific inquiry will soon be provided under Government auspices in this country.

LAND SETTLEMENT IN DENMARK.*

J. G. STEWART, M.A., B.Sc.,

*Superintending Inspector, Intelligence Department, Ministry of
Agriculture and Fisheries.*

IN so far as it is possible to judge in the course of a short visit, Denmark would appear to have satisfactorily solved the problem of settling people on the land.

As regards women in agriculture, Denmark, so far, cannot be said to offer any special object lessons. Women naturally find employment upon the land, but chiefly in side lines, gardening, poultry keeping, etc.; we saw no instances of women actually farming on their own account. Still, conditions such as prevail in Denmark seem particularly favourable for independent agricultural enterprise on the part of women.

Denmark is, pre-eminently, a country of small farmers. The question, therefore, as to how success has been achieved with small farms or holdings in that country is of prime importance to us at the present time.

In any scheme of land settlement, whether in this country or elsewhere, it is generally agreed that provision must be made to secure, on the one hand, that all persons placed on holdings shall have adequate capital (through loan facilities or otherwise), practical experience, and a sound general education; and, on the other hand, that the holdings shall be such as in size, character of soil, situation with regard to markets and facilities for co-operation, will ensure a good prospect of a comfortable living.

How are these conditions fulfilled in Denmark?

1. **Capital.**—According to the law of 1909, landed property may be purchased to the value of 6,500 kroner (£360) or, where the local values of land are exceptionally high, up to 8,000 kroner (£450), in respect of which the State will advance a loan in cash to the extent of nine-tenths of the value of the property.

A yearly interest of 3 per cent. is paid on the State loan, which is secured upon the property with its buildings, live and dead stock, etc. For the first five years the loan is free from part payments: after that period the loan has to be repaid in yearly instalments, including interest on the loan. The total loan will be liquidated in 98 years.

* This report was prepared by Mr. Stewart as a result of a visit to Denmark in 1919, with a delegation of women, who desired to study Danish conditions in relation to women's work on the land at first hand.

So long as the loan from the State amounts to more than one-half of the original lendable value of the property, no other mortgage can be raised upon it. The ordinary banks, the savings banks, and credit unions lend money on the security of land and stock.

There is no provision for compulsory purchase: the land must be bought by voluntary agreement with a willing seller. A Bill at present before the Danish Parliament seems to aim at the expropriation, on the basis of taxation value, of glebe lands, entailed estates, and the largest farms, for division among small holders. In this way it is hoped to secure about 100,000 acres, which will be parcelled out during the next 16 years. Parcelling-out societies formed to counter the activities of land speculators have been in existence for some years.

2. **Practical Experience.**—An applicant for a small holding under the Act (who may be a woman), must be a Danish subject, be over 25 and, as a rule, under 50 years of age, and must be unable, without financial assistance, to acquire a small holding. He must be of good character, sober, industrious and thrifty, and for the five years immediately preceding his application must have had practical agricultural experience.

3. **Education.**—The scheme of education for farm life in Denmark includes—

- (1) Rural Elementary Schools.
- (2) Folk High Schools.
- (3) Agricultural Schools.
- (4) Rural Schools of Household Economics.
- (5) Special Schools for Small Holders.

The *Rural Elementary Schools* are very similar to the parish schools in Scotland. They are attended by children of all classes of the community. Education is compulsory from 7 to 14 years of age. There are no fees. The management is in the hands of the local communes or parish councils under State supervision. The teachers are well trained and exercise considerable local influence. The usual fundamental subjects are taught, together with nature study and a language other than Danish—usually English or German. Danish and bible history, songs and hymns, gymnastics, etc., hold high place in the school curriculum. The children are bright, healthy, courteous and less self-conscious than our rural children. The school week is a six-day one, but as a rule the older children spend more time in school in winter than do the younger ones, while the reverse is the case in summer. During the busy

seasons the older children, therefore, are free to assist in farm work.

In general, the course is primarily designed to inculcate in the minds of the pupils a love for rural life and their native land.

After leaving the free elementary schools, a few of the children enter the middle schools, which are found in the larger towns. The majority remain on the land. Evening continuation schools are available for further study, but it is not till pupils reach the age of 18 years that admittance is given, as a rule, to any of the other schools referred to. Danish thinkers contend that the years of adolescence should be devoted to physical development and to gaining experience of life rather than to class-room routine. Almost every rural community has its local gymnasium where instruction in physical exercises is given, and its assembly hall where the people meet for self-improvement.

The *Folk High Schools*, so called because their aim is "high," are attended by pupils of both sexes from 18 to 25 and upwards. They are not as a rule co-educational—they are attended by men for five months in winter and by women for three months in summer. The chief subjects are history, literature, sociology, song practice, and gymnastics, but a certain amount of time is also devoted to natural science, mathematics, physics, geography, accounting, hygiene and sanitation, and to sewing and embroidery for women. The work is mainly based on lectures, and the success of the school consequently depends largely on the ability of the teacher to hold and inspire his pupils.

It is very difficult for the uninitiated to gauge the value of the high school teaching, but that it has exerted considerable influence in the intellectual advancement of the Danish nation can scarcely be doubted. It is claimed to have contributed to the making of a broad-minded, moral citizenship, to have fostered a deep-seated love of the soil and native land, to have freed the people from class domination and shown them how to utilise their political power, and to have laid a broad, cultural foundation for the successful tackling of the diverse problems of life.

About 50 per cent. of the students attending the agricultural schools have first passed through a high school; in some agricultural schools this is insisted on as a necessary preliminary. Most of the leaders in social and political life have graduated at the high school.

Agricultural Schools.—These are attended by young men of 18 to 20 or over (occasionally by a girl or two). The requirements for admission, which, however, are not strictly enforced, are usually (1) practical knowledge of farm work; (2) completion of a course at a high school. In regard to the former a system of apprenticeship prevails whereby a youth may spend three years on three selected farms—one year on each.

The main course of instruction is one of six months in winter with an extension course of three months in summer for more advanced study. In addition a special course of one month is usually provided for older men and women of experience who desire to become control assistants.

The longer courses embrace most of the subjects taught at our own farm institutes, but are more theoretical. Laboratory equipment is almost entirely lacking.

The course for control assistants includes lectures on dairying, accounting, feeding, manuring, and the testing of soils for acidity, milk recording and the use of the Gerber tester.

Each school has its farm or small holding attached, which is run mainly on commercial lines. Dalum School Farm extends to about 100 acres and carries 35 cows; that at Lyngby is about 32 acres and carries at present 11 cows, though the normal number is 16. Both farms are extremely well managed, and more than pay their way.

The agricultural school is intended to train practical farmers. Students desirous of becoming teachers must proceed to the Royal Veterinary and Agricultural College at Copenhagen, where a more advanced course is given, extending over 2½ years.

Schools for Small Holders.—Three schools have been established for the sons and daughters of small holders, with special short courses for small holders themselves and their wives. Two such schools were visited. Both are well equipped with buildings, comprising lecture rooms, gymnasias, dormitories, kitchens, and the usual accommodation for live stock and implements. Considerable areas of land, attached to each school, are used for general farming and horticulture.

The land attached to Koerehave School comprises about 200 acres, consisting of 100 acres of farm land, of which 20 acres are rented at 54s. an acre, 66 acres of wood, and 33 acres of garden and orchard. With the exception of the 20 acres referred to, the whole is the private property of the Principal. One of the agricultural teachers rents a 13-acre holding from

the school at 84s. per acre. An instructor in horticulture, a part-time member of the staff, has purchased a holding of 27 acres from the school for close upon £100 an acre and is running it for nursery purposes, fruit and milk production. The Principal intends to cut off one more small holding, to be let to another teacher on what are conceived to be improved lines.

The school farm is relatively understocked, carrying only 11 cows, a few calves and about a score of pigs.

Fruit-growing in Denmark is still in its infancy, and, in general, receives little attention. The school orchards have been carefully planned and are full of lessons for future growers. Most of the better known varieties of apples, pears and plums grown in England are represented, but only in respect of pears have the imported kinds attained any appreciable success. Even in pears the Danish "Greve A. V. Moltke" is much the most reliable and the most prolific cropper. This pear should be worth a trial in England if not already grown here; it is sold to the French as King Christian of Denmark.

Apple culture, so far, is not a success: most of the varieties are badly cankered.

Of the bush fruits, red currants are the best; gooseberries are badly affected with the American mildew.

The woods, which are the special care of the Principal, have been laid out with much taste and originality. The scheme includes shady walks, secluded open-air theatres and sports grounds. Here visitors congregate on high days and holidays to hear the leaders of Danish thought discourse on history, literature, art and sociology.

The Odense School Farm is 85 acres in area, and cost £4,500 six years ago (about £53 per acre, including buildings). The farm is let to the lecturer on agriculture at a rental of 84s. 4d. per acre, and consists, for the most part, of poor, light, black sand overlying an equally light subsoil. The cropping is as follows: one-third roots and potatoes, one-third lucerne and grass (two years), one-third corn and peas. The cows number 12, about half the normal head, and there are 14 head of other stock.

The courses of instruction at both places are similar in character. They comprise, winter and summer, five- or six-month courses in agriculture and horticulture for men, and corresponding courses in household economics for women. In addition, several short courses of eleven days each are held throughout the year for older men and women.

The longer winter courses are similar in scope to those given at the agricultural schools. The summer course provides for a class of pupil who works on the school land and who, in addition to free tuition, board and lodging, receives pay from the State. The special 11-day courses are devoted to lectures, visits to farms, factories, etc., recreation, song and social enjoyment. Such a course affords rest and change from the routine work and isolation of a small holding and provides the benefits which arise from contact with fresh people and fresh problems.

These schools are of comparatively recent origin and were intended to devote special attention to side-lines, such as poultry-keeping, bee-keeping, and rabbit-breeding ; but except for some useful poultry and poultry-houses at one centre nothing of note was seen in this connection.

The Danes are out for *Education* rather than *Technical Instruction*.

As compared with our institutions, the instruction given at the higher educational centres in Denmark is, in general, more elementary, more theoretical, and takes the form mainly of lectures. The "living word," without embellishment in the form of illustrations or lantern slides, is the chief instructional means employed. On the other hand, the students, as a rule, are better versed than ours in practical farm work before they enter the schools. There is, however, just a danger of the Danes becoming, as one educationist expressed it, a nation of listeners rather than thinkers.

The schools in Denmark are practically all residential, and at some of them, e.g., the Small Holders' Schools, men and women attend together to their mutual advantage. More attention is also paid in Denmark to the "humanities," recreation and social life.

In contrast with Britain, most of the agricultural educational institutions in Denmark are privately owned, either by the Principal or by groups of farmers or small holders. The farms are utilised chiefly as a means of supplying produce to, and helping to finance, the school : they play little, if any, part in the teaching.

The State contribution towards the annual cost is usually from 2,500 K. (£140 12s. 6d.) to 3,000 K. (£168 15s.). Fees (including board and lodging) are usually 75 K. (£4 4s. 5d.) per month, or 450 K. (£25 6s. 3d.) for five months (including extras). Half of this sum may be paid by the State.

4. Size of Holding and Its Equipment.—

Size.				Number.	Total Area.
7	acres and under	..	..	116,614	239,604 acres.
7	„ to 11½ acres	..	..	16,988	159,832 „
11½	„ 22½ „	..	..	28,992	473,598 „
22½	„ 33½ „	..	..	17,723	496,962 „
33½	„ 67½ „	..	..	35,257	1,752,121 „
67½	„ 135 „	..	..	25,615	2,346,295 „
135	„ 270 „	..	..	6,502	1,169,484 „
270	„ 540 „	..	..	1,570	574,946 „
540	„ and over	..	..	822	964,327 „

250,083 8,177,169 acres.

Average size of holding = 30 acres (approx.)

In the old days Denmark was divided into large estates, much the same as in this country. The process of sub-division had begun in the 18th century, and the disastrous war of 1864, followed by the disappearance of profit from corn-growing, accentuated the process. At the present time over 90 per cent. of the Danish farmers own the land they farm.

Of State small holdings there appear to be about 9,000 of an average size of about 9 acres.

We were able to visit a colony of 17 State small holdings near Ringsted, in Seeland, which had been parcelled out of a farm 12 years ago. In size they vary from 5½ to 27 acres, with an average of about 12 acres.

Each holding is a separate unit with its own complete set of buildings, and the land is conveniently arranged around the buildings. Each has access to a good road.

The *Buildings* are substantial and well kept up; they are built of brick and roofed with tiles or, occasionally, thatch. The dwelling-house consists, as a rule, of two sitting-rooms, kitchen, scullery, and two bedrooms, with floor above. Water is laid on from a supply on the estate worked by a windmill, and in charge of one of the small holders. The outbuildings consist of two, sometimes three, wings situated behind the dwelling-house, and comprise cow-house, stable, piggery, barn and store. The cow-house and stable and sometimes the piggery are usually under one roof. All are provided with concrete tanks for liquid manure, and most of them with open, concrete dung-steads.

Stock.—A typical 11-acre holding possesses 3 cows (4 in normal times), 3 to 6 young stock (calves and heifers), 1 sow or 2 or 3 store pigs (before the War such a holding delivered to the bacon factory from 10 to 20 pigs annually), from 10 to 40

hens, and up to 80 chickens, and 1 or 2 horses. In some cases neighbouring holders each keep a strong, active horse and work together, usually carting milk to the factory as well, but in most cases each holder possesses 2 ponies, usually Icelanders, about the size of our pit ponies. The Iceland pony is believed to be an important factor in the successful working of a small holding. Before the War such a pony cost about £8 10s., now he is worth £42. He is very hardy, active and willing, and, it is claimed, two cost only about as much to keep as one big horse.

The main source of income is milk, which is collected at the door by the co-operative dairy. The cows—Red Danish—are smaller than our milch cows and not so shapely, but they have all the points of good milkers. No milk records, as such, are kept on the holdings in question, the returns from the co-operative dairy being considered sufficient. One holder delivered last year 14,000 lb. from 3 cows, as compared with 28,000 lb. from 4 cows before the War. Another milking 4 cows gave the yield per day at the date of our visit (3rd June), as follows:—

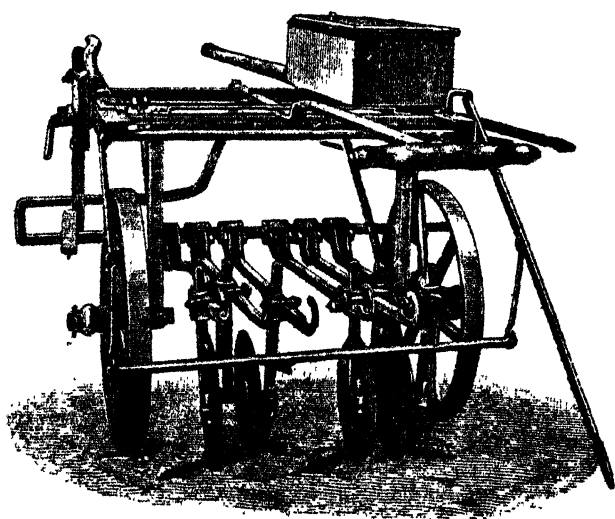
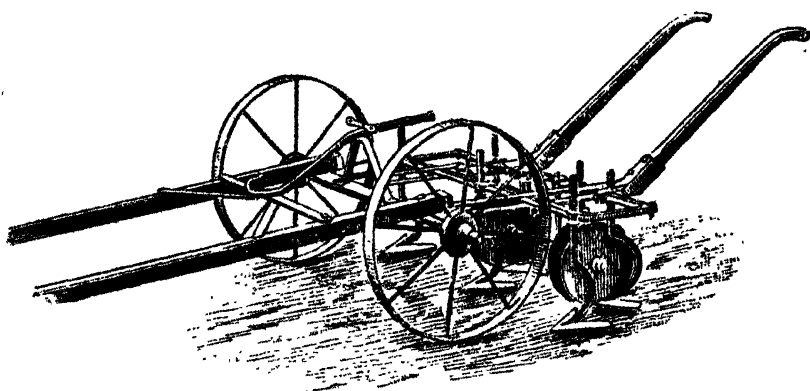
1 heifer, calved Christmas	..	..	=	20 lb.
1 cow „ 6 weeks ..	..	..	=	29 „
1 „ „ 2nd March	..	..	=	35 „
1 „ „ 11th „	..	..	=	42 „

About 700 gal. per cow per annum is considered a good average.

A bull is usually hired from a bigger farmer: one, owned co-operatively, died, and as he was not insured, funds were lacking wherewith to purchase another.

The pigs are of white Danish breed, very similar to our Large White Yorkshires, to which they are closely related. Boars belonging to neighbouring farmers are used; in one case the boar at the small holders' school.

Implements.—The holdings are invariably well equipped with implements of the small-holder type. A light plough of the "Oliver" pattern and a Danish horse hoe, convertible into a root drill, are perhaps the most noteworthy. The latter is adapted for cleaning roots on the flat—two rows being taken at one time: a pair of discs fixed about 3 in. apart straddles each row of plants, and flat cutting-shares operate between and at the outside. The discs protect the plants from being covered up by the working of the shares. One horse is required to pull this excellent tool. Many of the holdings have their own



Horse Hoes suitable for Cleaning Roots on the Flat.

(Maker : Christopherson, Holeby.)

threshing machine. It is a simple affair, driven by horses, and consists mainly of a drum to beat out the grain ; winnowing is done afterwards. It is capable of threshing 600—700 lb. per hour, and cost (pre-war) 300 kroner (£16 17s. 6d.). Some possess chaff-cutters, root-pulpers, corn-drills and mowing machines. Co-operation in regard to implements is rare, but one or two holders may share a threshing machine.

The small holder schools are endeavouring to encourage, in combination with milk production, the growing of flowers and roots for seed, and the cultivation of fruit, but such examples as we were able to see were not very promising.

Larger Holdings.—A visit was also paid to four farms in the same locality. In size these run from 75 to 85 acres (average 80 acres) and, with one exception, are owned by the occupiers. The exception is the case of a son renting from his father: the son entered the farm before the War, and pays a pre-war rent of 33s. 9d. per acre, although it is generally acknowledged to be worth 67s. 6d. at the present time. (Not far away, and on soil of similar character, an occupant of a 10-acre holding is paying 84s. 4d. per acre rental.) Rates, in general, come to 7s. or 8s. an acre.

The land is mainly arable and is worked on a seven- or eight-course rotation. Hay is usually taken from the second year grass, and the land is subsequently dunged and half-fallowed in preparation for wheat. Crops in general were good, particularly rye and roots, though "seeds" in some cases were thin and lacking in clover.

Red Danish cows are the main class of stock kept: these are bigger and in better condition than the small holder's cows, and are probably producing more milk. A usual yield is stated to be about 800 gal. per cow per annum. Records are mostly kept, monthly weighings being made by the Control Assistant.

The cows are tethered at grass from May to the end of September, are moved several times a day, and milked thrice. Only one collection of milk is made daily by the factory, but the different milkings are kept separate, and during hot weather the milk is cooled by standing the cans in cold water.

Winter feed during the War has consisted mainly of roots, straw, and sometimes hay, with either no concentrated food in addition or from 2 to 4 lb. daily per head, according to the supplies which the farmer has himself been able to produce.

All rye and wheat were taken over by the State, and most of the oats and barley. In regard to the last-named cereals, the Government fixed a quota which it was considered the holding should be able to spare after retaining sufficient for seed purposes and for the horses. Nothing was allowed for other stock, but such quantity as might be produced in excess of the Government requirements could be disposed of by the farmer at his discretion. This provision operated greatly to the disadvantage of occupiers of the lightest soils where rye is the principal crop.

In regard to cow-carrying capacity, it was found that the average number of cows maintained was 28, approximately

one cow to three acres, about the same as in the case of small holdings. (An ordinary cow is worth about £45; a cow of special milking pedigree will make £90 or more.)

In addition to cows, young stock—calves and heifers—to the number of about 20 are maintained on each holding. These comprise from three to eight bull calves, worth at present from £90 to £225 each (the latter out of a cow that gave 500 lb. of butter-fat annually for four years).

Horses are invariably good and are mostly of the vanner type. A lighter-limbed horse is also used, somewhat resembling the English hackney. One of this class, a four-year-old mare that had won several prizes locally, was said to be worth about £340.

An 80-acre farm usually carries five working and three other younger horses and nags. This relatively heavy stocking is said to be due to the necessity for keeping the land constantly stirred, but a further explanation is the keen trade in horses during the War and the demand for horse flesh for human consumption.

Pig stocks have been much reduced of late. On one farm there were 24 pigs, as compared with a pre-war figure of 200. The average number per farm at the time of the visit was about twelve of all ages.

As regards labour on these farms, about four men are employed continuously throughout the year, and two extra men for singling and lifting mangolds and beet. As a rule the foreman occupies a cottage on the farm, and his wife assists in milking. The hired men are accommodated and fed at the farm in much the same way as in Scotland. Adults (males) are paid about £56 5s., and women for housework about £23 12s. 6d. per annum, in addition to food and lodging.

The farm-steading is usually arranged in the form of a square the farm house occupying one detached wing, and the outbuildings three wings joined together. The steading is usually built of brick and roofed with slates or thatch, and is invariably substantial and kept in good repair. The main feature of the outbuildings is the cow-shed, usually consisting of a double row of stalls arranged tail to tail, with feeding passages in front. Connected up with this is a large concrete tank for the urine. The stalls are not washed down with water, consequently the manure is preserved pure. To obviate the passage of the solid excrement into the tank and to prevent it damming

up water in the grip, the latter is constructed with a depression at one side covered with a wooden plank, thus :—



There is ample barn accommodation—in one case the whole of the corn crop is stored under cover as it comes from the field—and a good stock of implements and food-preparing machinery.

The farm house is well furnished and scrupulously clean, and displays a degree of comfort and prosperity that one does not find as a rule in this country on farms of the same size.

The farmers' children, and in some cases the farmers themselves, have attended the high school and the agricultural school.

As compared with the small holdings it cannot be said that the crops are heavier or the land better managed ; the cattle, however, are bigger and in better condition, and more attention is paid to the use of better sires in breeding.

5. **Climate, Soil and Crops.**—The climate of Denmark is characterised by comparatively mild winters and cool summers. The rainfall is, on the average, about 24 in., but is very variable in the different years. The country is flat to undulating, sparsely wooded, and subject to winds.

The soil for the most part is drift, consisting mainly of fine sand or gravel with a little clay. It is light, free-working and hungry, but responds readily to good treatment and plentiful applications of farmyard manure. Over the islands the soil closely resembles the fine black sandy soil found in the neighbourhood of Ormskirk ; in the centre of Jutland it is mainly stony sand and very poor, similar to the " Bagshot " districts of England.

The character of the soil—light, free-working, yet responsive—is probably one of the main factors in the success of the Danish small holder. Light implements and light horses suffice, and the Dane has solved the problem of the cultivation of roots—the foundation of his scheme of cropping.

An eight-year rotation is almost universally adopted. On the colony previously referred to the cropping is, generally, as follows :—

Rye (or wheat),
Roots,
Barley,
Roots,
Légume and cereal mixture,
Grass,
Grass (with half fallow),
Oats (or wheat).

There is no permanent grass on this colony, and except for some low-lying meadows in the islands and the marshes of Jutland there is very little permanent grass in the country.

Very little artificial manure seems to be used by small holders: the roots may get some nitrate of soda and superphosphate, but in the main reliance is placed on farmyard manure. Dung is spread on the second year grass about mid summer after once grazing or mowing; the grass is then half-fallowed for autumn corn; a proportion of the dung is applied, usually in early winter, for roots.

Liquid manure is used on the grass and is applied without dilution when the grass is wet, chiefly in autumn and spring.

Excellent crops of rye are grown.

Roots consist of mangolds, sometimes sugar beet or sugar mangold, swedes and turnips. The land is well worked; the use of the roller and horse hoe for conserving moisture is thoroughly understood. There is a saying in Denmark to the effect that if it is possible to walk over a root field without getting one's sabots filled with soil it is not in a proper condition of tilth.

Roots are usually sown on the flat in 18 to 20-in. rows and are thinned out 8 in. apart. Good yields are obtained: in one case a small holder's crop last year worked out at 35 tons per acre. It is a remarkable fact that throughout the whole of our tour not a single root failure was seen, even on the very light lands of Jutland—this notwithstanding the fact that the rainfall for May was only 1 mm. as compared with a 40 mm. average, and that there was practically no rain during our visit in the first half of June.

The grass crops consisted of approximately equal proportions of rye-grass, cocksfoot and tall oat grass, with lesser amounts of Timothy, red clover and alsike. Obviously a mixture of this kind cannot form a close bottom, and most of the fields which, at the time of our visit, were in full flower, were thinner than we like to see in this country. On small holdings and in the islands generally all cattle are tethered at grass. In Jutland where the holdings run larger and where there are numerous low-lying meadows the cattle often graze at large.

The system of tethering stock is prompted by the belief prevalent in Denmark, and supported, it may be remarked, by experiments in Ireland, that more feed is obtained by allowing grass in any given pasture periods, here and there, of uninterrupted growth than by grazing continually over the whole extent. It is admitted that the milk yield begins to drop when the flowering stage is reached and at the same time more of the grass is wasted. To reduce waste, small holders sometimes bring their cows in about midsummer and feed the grass in the stalls.

Where tethering is practised, the bulk of the grass becomes well established before the dry weather sets in and is thus able to hold its own even during a spell of drought. So much are the effects of drought feared that farmers hesitate to cut their hay before the drought has broken, and an aftermath is as ured.

Lucerne is less grown than might be expected, and winter beans are not cultivated at all. Intensive cultivation in the form of continuous cropping is unknown, and as regards rotations, generally, it is doubtful if Denmark can teach us much.

6. Returns.—We were unable to examine actual balance sheets, but the small holders freely disclosed, so far as they were able, their financial condition. One holding of 11 acres cost, twelve years ago, 500 kroner per tondeland (£20 14s. per acre), buildings cost 4,000 kroner (£225); 6,300 kroner (£354 7s. 6d.) are still owing. In the case of a holding of 13½ acres the land cost 600 kroner per tondeland (£25 per acre), buildings cost 5,500 kroner (£309 7s. 6d.). The holder is paying interest on 6,700 kroner (£376 17s. 6d.). In another case 12,500 kroner (£703.2s. 6d.) were paid for a holding of 11 acres, five years ago. This included land, buildings and equipment. About five-sixths of this is still owing. Another paid 10,000 kroner (£562 10s.) for an 11-acre holding six years ago, and still owed seven-tenths of the amount.

One holder transferred in 1918 to a bigger holding (11 acres) for which the full purchase price was 22,000 kroner (£1,237 10s.); of this amount he paid down 13,000 kroner (£731 5s.). This small holder expressed the opinion that the would-be purchaser should possess not less than one-third of the total purchase price.

The general impression conveyed was that the small holders were making a comfortable living and had not much anxiety

for the future. They are content to live soberly and thriftily, they do not have to work hard, and they are content if there is a small balance left over after paying interest and household expenses. This balance naturally varies : from £28 to £56 on a holding of 13 acres is considered reasonable.

The worst conducted holding of those inspected was one of about 5½ acres, and in this case the small holder earned part of his living by working for other people (carting, etc.). In the case of another holding of the same size the small holder kept 3 cows, 1 horse, 1 pig and 1 calf (12 weeks old, just sold for 220 kroner (£12 7s. 6d.)). Two of the cows were at grass on another holding ; the small holder earned 800 kroner (£45) independently of his holding. The crops in this case were good. We had no further opportunities of inspecting the smallest type of holding ; there appears, however, to be a general consensus of opinion that the minimum size should be big enough to provide a living in itself.

7. Farming in Jutland.—A visit was paid to Herning, the "Capital of the Jutland Heath," and some time was spent in exploring the country around that centre. Approaching Herning from the south one passes through an extremely poor, sandy country closely resembling our Bagshot Heaths, with this difference, that the Jutland Heath is closely settled and mostly cultivated. As seen from the central Jutland railway the land is much poorer than in the islands, the holdings are bigger and more scattered, and the cattle are not tethered to the same extent. Very little rain had fallen during the previous two months and the country as a whole was obviously suffering severely from drought. In this connection it was noticeable that where tethering was practised the grass was green and vigorous, whereas in the fenced fields where the cattle grazed at liberty the herbage was short, poor and "burned."

One was struck with the newness of the small towns or villages through which the railway passes, and the large numbers of new farmsteads along the line side. It would appear that the railway was laid through a barren heath and that gradually the stations and approaches to the railway became centres of human habitation and industry. Herning, a flourishing looking town of 7,000 inhabitants, has grown up within the last 30 years. It contains a bacon factory, two dairies, and excellent elementary, middle, high and technical schools. There are two brick factories and several large peat "banks" on the outskirts. During the War the cutting of

peat has developed into an important industry in Jutland. Herning is entirely dependent on peat for its fuel, and large quantities have been transported to the principal centres of population in Denmark, where peat fuel was unknown before the War, at a cost of 33s. 9d. to 40s. per ton delivered. The peat is sold on its analysis: a good sample will contain 25 per cent. of water and 2 to 3 per cent. of ash.

One typical small holding, about 1 mile from Herning, was visited. This consisted of 9 acres and cost £23 4s. 1d. per acre before the War. Buildings consisting of cow-house, stable, piggery, and dwelling-house—all in one block—cost £135. The soil is black peaty sand, deeper and richer than typical heath soil, and is cropped as follows:—

Roots,
Oats,
Grass,
Grass,
Cereal and legume mixture (ripened),
Rye.

There is, also, a small, well-managed garden from which some produce is sold. The stock at present consists of two horses and two cows. Both crops and stock are only moderate. The land is in need of lime and will be dressed with clay marl obtainable locally (pre-war price = 1s. 4d. a load). Normally a few pigs and other stock are kept, and the holding is said to be entirely self-supporting. Latterly, however, the occupier has had to engage in carting and other outside work in order to make ends meet. For carting peat, for example, a man and two horses will earn from 50s. to 55s. a day. On poorer heath soil—farther from Herning—about 40 acres is considered necessary for a living.

West of Herning many of the holdings range between 60 and 100 acres. Except roots and rye, crops generally were poor. Some of the best crops in the district were to be seen on the Government Experiment Station at Studsgaard.

Here the soil is extremely light, black sand, on which experiments are being conducted to determine the best crops and the best varieties of such crops to grow. Rye, oats, barley, roots, potatoes, carrots, grasses, clover and miscellaneous forage plants are included in the trials. Rye and potatoes are very good; carrots also do well; and of the forage plants tall oat grass and red clover seem to be about the best. Lucerne is poor alone, but moderately good along with tall oat grass.

A usual rotation is :—

Lupins—ploughed in,
Rye,
Potatoes,
Oats,
Sugar beet,
Rye,
Grass,
Grass.

Lupins have been sown at different times, and, judging by the appearance of the succeeding rye crop, the earliest-sown lupins have answered best, due to the greater bulk of crop ploughed in.

One of the most successful experimental rotations, judging by the crop yields, is lupins followed by rye followed by potatoes. Lupins are ploughed in, and never fed to stock.

A trial is being made of pit ensilage.

In an easterly direction from Herning, towards Silkeborg and Skandeborg, the railway passes through a peat country containing wide stretches of flat, grass marshes used for grazing both dairy (Black and White Danish) and store cattle. The latter are mainly Shorthorns or Shorthorn crosses bred from English bulls. Farther on, blocks of large holdings, less well equipped with the cleaning implements seen on the islands, alternate with clusters of small holdings and some fine belts of spruce and pine. Then come treeless stretches of boggy land cultivated on 8-yd. "stitches," with intervening open ditches 2 ft. deep, and again more black sandy heath and small 10-or 12-acre holdings, with heaps of marl lying about ready for application. This so-called marl is mostly clay with about 30 per cent. of lime, and costs about 3s. 6d. a ton. So light is the soil that to prevent blocking by blown sand the railway is protected by close "sleeper" fences. The soil is still cultivated, however, even when so poor that the coarse white sand shows through the growing crops: only the flat, intractable bogs remain uncultivated and these are being worked for peat.

One then reaches the Lake District of Denmark—a poor stretch of country, little cultivated, but beautified by heath and pine. Silkeborg is the centre of the wood-pulp paper industry.

8. **Forestry in Jutland.**—A good deal of tree-planting appears to have been done in recent years: however poor the soil, small belts of spruce and pine were everywhere seen in flourishing condition; many of the fields, too, are hedged around with

pine as in the light land districts of Norfolk. The health and vigour of these conifers, even where scarcely a green blade was visible, and where the land was red with sorrel, greatly impressed the onlooker.

A visit was paid to the plantations of Hjortsballehoeje in central Jutland. On this bleak and barren stretch of light sandy moorland the Danish Heath Society started planting in 1866. The land was ploughed over roughly in furrows 12 in. wide by 6 in. deep, and left for a season. Afterwards it was knocked about and finally thrown up in 5-ft. "stitches" and planted with spruce (*Picea excelsa*). This did not flourish and trials were made with Mountain Pine (*Pinus montana*), which is more of the nature of a shrub than a tree, stooling out into four or six main stems and reaching a height of 10 ft. or so. The spruce and pine grow well in mixture, and the method now adopted is to cut out the pines at from 20 to 40 years' growth, by which time the spruce is thoroughly established. The latter remains and makes quite useful timber. The pine is used mainly for firewood and in the production of charcoal and tar. There seems little doubt that much of our own "heath" country could be similarly afforested, providing useful employment for large numbers of men or women and helping out by means of casual work the small holder located on the borders of the forest.

9. **Remarks.**—To sum up, a small holder in the Islands of Denmark is able to make a comfortable living with no great exertion from about 11 acres, provided, of course, he employs no extra labour. It was suggested to us by one of the most capable small holders we met that 16 acres would be a more economic unit and that one man would still be able to undertake all of the work. In the lighter districts of Jutland an economic unit is rather larger than in the Islands (from 20 to 30 acres or more according to the soil); in these districts the land is worked in much the same way as in the Islands, and sometimes the smaller men eke out their living by cutting and selling peat and by work in the woods. Rye and potatoes are the most reliable crops on the lightest soils, the latter being grown more extensively in Jutland than in the Islands, where a small holder rarely grows more than is sufficient for his own household.

The sale of milk, the price of which in June last was about the same as in this country, brings an assured and regular income. The cows, especially the Red Danish, are uniformly good milkers and would appear to require rather less food than ours. During the War the small holder's cow has suffered

more than that of the bigger farmer, and it is doubtful if, at present at all events, the small holding, acre for acre, produces as much milk as does the larger holding. There is less difference between the two classes of holding in regard to crop production. While the numbers of cattle (not cows in milk) have practically been maintained, pigs have fallen off during the War, from a total of about $2\frac{1}{2}$ millions to half a million. The Dane had become accustomed to fatten his pigs on separated milk and barley meal or millers' offals, and when the supplies of these fell off (separated milk being used largely in cheesemaking, etc.) he seems to have been at a loss to find a satisfactory substitute.

In regard to education, the Danish small holder is perhaps slightly better equipped on the average than the small holder in this country, and he values it more highly. Whether as a result of education or temperament or some other cause difficult to define, the Danes are imbued with a spirit of helpfulness, neighbourliness, and frankness in regard to their private affairs that makes the path to co-operation easy. The progressive majority adopt it and the others have to follow suit, or fail to find a market for their produce. The chief reason, however, for the success of co-operation is, probably, the dense concentration of small holdings and small farms, all turning out the same products. This is a result of uniformity in soil conditions, the fact that agriculture is the main industry of importance, and the popular love of soil and native land. Added to this is the fact that everything possible is done by the legislature, composed largely of farmers, and by the rural councils to help the small holder in his task. Financial assistance is obtainable on easy terms; while the holdings are excellently equipped with buildings and each is a self-contained unit. There is no such thing as the sharing of buildings; there are no disjoined holdings; and the joint use of horses, implements and machinery is rare.

The same combination of circumstances in this country is seldom met with; but the wide stretches of light, free-working soil capable of improvement by liberal applications of farmyard manure, which are to be found in many districts, would seem to make likely centres for trials of small arable dairy holdings. In Denmark the milk goes to the co-operative creamery, which, on the average, has a membership of about 140 and deals with the produce of about 700 cows. The cream is used for butter-making and the bulk of the separated milk is returned to the farms for pig-feeding. In this country the milk would probably be destined for sale in the towns, and the only form of co-

operation directly called for would be the collection of the milk at the holdings for dispatch to the nearest station or depot. In the event of a surplus the additional organisation required to run a cheese factory, with the principle of co-operation already to hand, would necessarily be more easily provided.

A further reflection was suggested by the marked similarity between much of the land in Denmark with land in Norfolk and Suffolk. In these counties large tracts of light land are now devoted mainly to sheep-farming and sport. Similar land in a small country like Denmark would probably be carrying a cow to every 3 acres and contributing more largely to the wealth of the country and the re-instatement of a healthy rural population.

FARM DRAINAGE MACHINERY.

MAJOR J. G. MERRISON.

FARM drainage by mechanical means is recognised to be a subject of pressing and increasing importance to the British farmer, but little is known in the United Kingdom of the methods employed elsewhere, particularly in Canada and the United States. In those two countries high wages and a scarcity of skilled labour gave rise long ago to conditions very similar to those obtaining to-day in the United Kingdom, where manual labour is now in a great many cases so expensive as to be prohibitive. This article is not intended to explain the benefits to be derived from draining, or to discuss the methods to be followed in particular circumstances, but to describe and illustrate the various classes and types of machine successfully employed in this country and abroad.

Drainage machinery ranges from small ploughs and scoops, costing but a few pounds, to elaborate machines costing thousands. Many and widely different conditions require to be met in drainage, and machines have been designed for practically all possible conditions; but for purposes of classification it will be convenient to divide the machines into four definite groups:—

1. Ploughs and scoops.
2. Wheel excavators and endless chain excavators.
3. Steam tackle.
4. Scraper excavators.

I. Ploughs and Scoops.—This class includes the smallest and least expensive type of implement or machine. The main advantage of machines of this class is their low cost ; they meet the requirements of the farmer who has only a small amount of drainage work to do, which he will fit in with the general work of the farm, employing men and a team or tractor when they are not required for other operations. A heavy initial outlay on speedier and, mechanically, more efficient machines, would be clearly false economy for the farmer with only a little drainage work to perform : if such machines are to be employed for his work they will be owned by a contractor or some local authority.

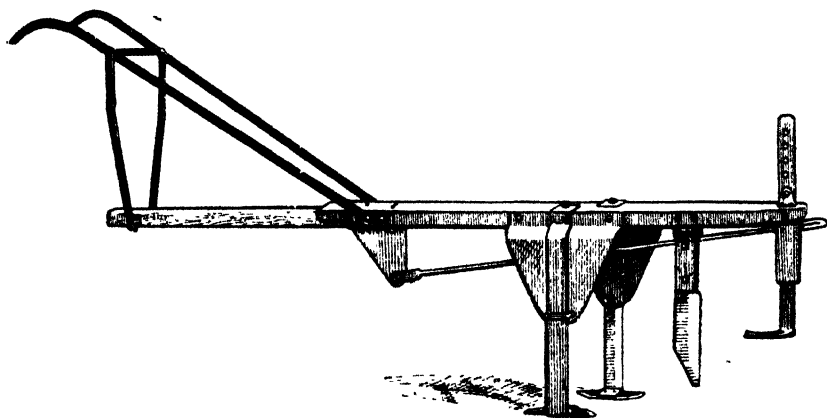


FIG. 1.—The Dawson Ditching Digger (Toronto).

(a) *The Ditching Digger.*—Fig. 1 shows a very simple device used to deepen existing open ditches, and to loosen the soil preparatory to shovelling when excavating trenches for tile drains. The implement is constructed on the lines of a plough, to the beam of which are attached vertical standards with a cutting edge, and a coulter which splits the ground ahead of these cutting knives. At the end of the knives are fixed spade feet to loosen the earth at the bottom of the trench. The depth of cut is regulated by a shoe at the head. With the exception of a wooden stay the implement is constructed throughout of iron and steel, thus ensuring the maximum strength and stability. The weight of this machine is approximately 180 lb. Two men and two horses are required to work the machine, which costs about £8.

(b) *The Ditching Scoop.*—Fig. 2 illustrates an implement known as the ditching scoop. It consists of a heavy U-shaped

cutter which loosens the earth, and a bucket in the rear for collecting the soil. The cutter is mounted on a steel frame. The bucket is fixed to the cutter frame by steel straps. The wooden handle is hinged to the bucket and is used to keep the machine upright when entering the trench. The bucket is filled by being drawn up the sloping end of the uncompleted part of the trench. The depth of each cut is controlled by an adjustable shoe in front of the cutting knife. The bucket is $3\frac{1}{2}$ ft. long, 17 in. high, and 10 in. wide at the top, and will hold about 5 cub. ft. of soil. When charged the bucket slides out of the trench, the handle is disengaged and the bucket falls on its side. A loop on the bottom of the bucket offers a hold for turning it, and perforation in the bottom prevents the soil from being held in the bucket by suction. Two men and a team of horses are required to operate this scoop. The implement costs about £10.

(c) *Soil Scrapers and Scoops*.—Figs. 3 and 4 show respectively a scraper and a scoop, used for removing the soil from open ditches after it has been loosened by a plough. Fig. 3 shows the type of scraper used when the soil has to be deposited on the side; the scraper works across the ditch and deposits the soil on the edge of the bank, leaving sloping sides. Fig. 4 shows the type used when the soil has to be carried some distance. It will work either crossways or lengthways according to the size of the ditch and the nature of the soil. Two men and two horses are needed to operate these scoops, the cost of which is from £3 or £4 upwards, according to size.

(d) *Farm Ditcher*.—Fig. 5 shows a handy machine for making drainage ditches, grading and building roads, terracing, back-filling tile ditches and filling gulleys. As a ditcher the machine cuts a V-shaped ditch with sloping sides from 4 ft. to 6 ft. in depth, according to the nature of the soil in which it is used. The machine is built in two sizes, a 300-lb. machine equipped with a 5-ft. cutting blade and a 375-lb. machine with a 7-ft. cutting blade: the former requires two horses on light soil and four on heavier soils; the latter requires from four to eight horses, or can be used with a tractor.

(e) *The Swedish Excavator*.—Figs. 6 and 7 show two sizes of a Swedish machine, the "Revolt" excavator, which has been imported for use in this country. The U-shaped share serves to scoop up a layer of soil: the loosened soil enters the lower part of an inclined conveyer that carries it to the top of the machine, where a discharge chute returns it to the ground on the side of the trench. An adjustable shoe in front regulates

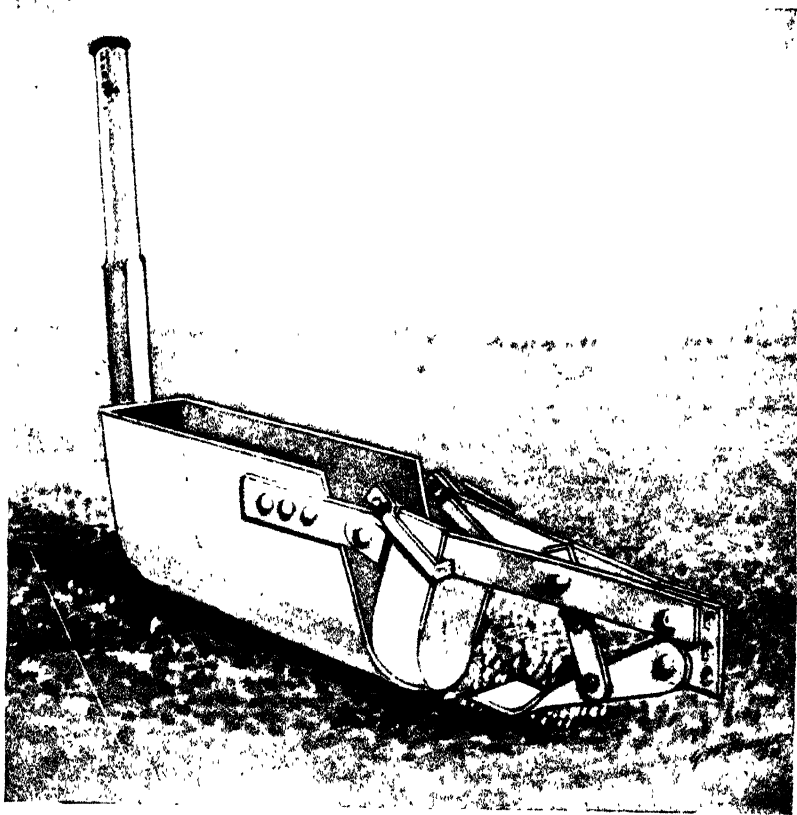


FIG. 2.—Ditching Scoop.

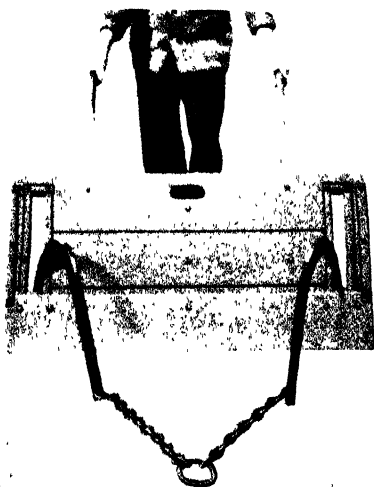


FIG. 3.—Soil Scraper.

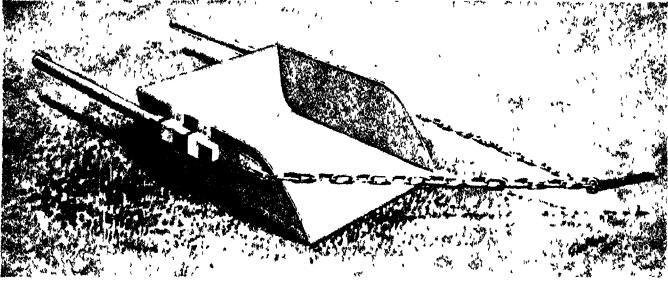


FIG. 4.—Soil Scoop.

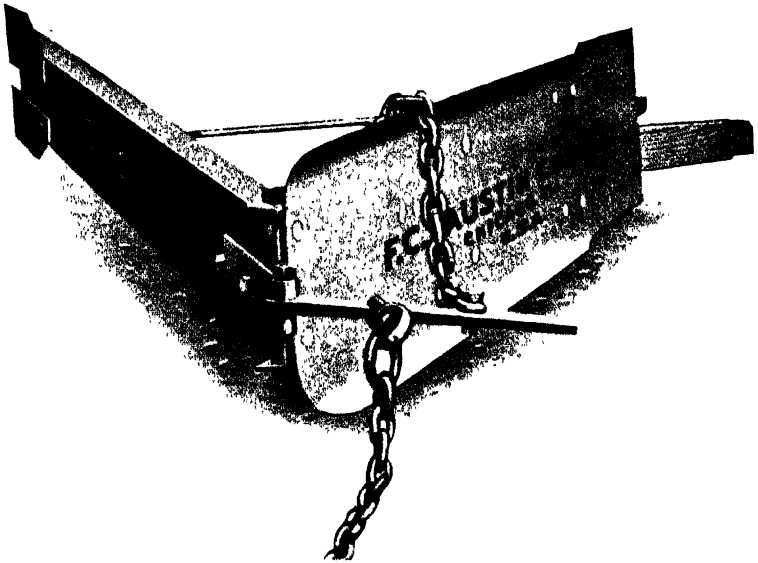


FIG. 5.—Austin Farm Ditcher, Terracer and Road Grader.

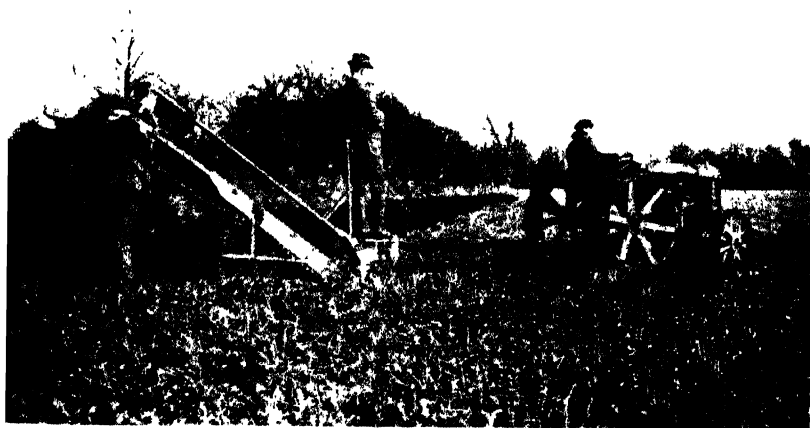


FIG. 6.—Swedish Excavator and Fordson Tractor.



FIG. 6A.—Swedish Excavator and Fordson Tractor,
Rear View.

the depth of the cut. The conveyer is driven direct by a combined cog and carrying wheel that runs along the bottom of the ditch. It is claimed that the smaller machine (Fig. 6) with two men and two horses will dig 300 to 400 yards of ditch per day (7 in. wide, 3 ft. 7 in. to 4 ft. deep); and the larger machine (Fig. 7) with four horses and three men, 400 to 600 yards per day (12 in. wide, 4 ft. deep). The smaller machine has been tried very successfully in England, both under easy conditions and in stiff clay. It is understood that near Boston, Lincs, working in light, loamy soil with a sandy bottom, the machine with two horses cut a trench 130 yards long and 3 ft. 6 in. deep in $1\frac{1}{2}$ hours, and with a Fordson tractor cut 100 yards 3 ft. deep in

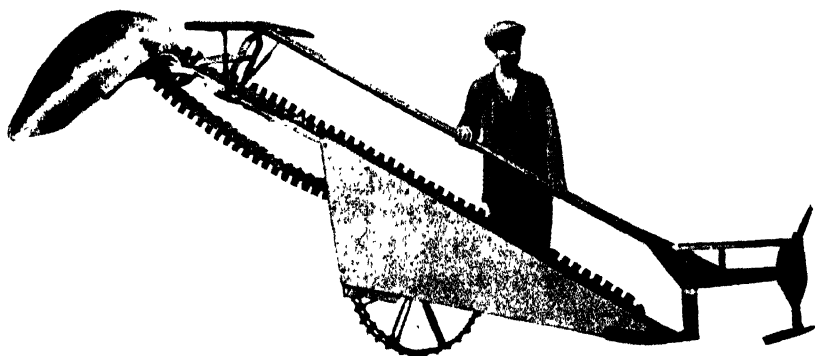


FIG. 7.—Swedish Excavator (large size).

half an hour. The present price of the smaller machine in this country is about £40.

2. Wheel and Endless Chain Excavators.—These machines are used by contractors and persons having a large amount of farm tile-drainage to do. To meet successfully varying soil and other conditions and to avoid breakage and loss of time, machines must be capable of digging exactly to a determined gradient, be free from mechanical trouble and resistant to heavy overload. The machines consist of a strong, rigid frame and platform carrying the engine and gears, and are so designed as to be self-propelling. Internal combustion engines are generally used, though steam engines and boilers are often preferred. The digging attachments are so mounted and hinged to the moving platform that they may be raised or lowered by the operator in securing the depth desired. Levers are so arranged that the depth of excavation can be accurately controlled by the person operating the machine. An arm or gauge is attached to the digging frame in order

that the operator can sight across it to targets set along the line of trench at a known height above the desired bottom, and the machines thus cut true to a given gradient. Manufacturers now fit these machines, especially the heavier ones, with multipedal or caterpillar tracks, although some of the lighter machines are still mounted on four wheels. The machines are moved by applying the power directly to turn the wheels or tracks. The speed at which the machine moves forward can be regulated by the traction gears, which may be changed at will. Shields are fitted to the machine to prevent the sides of the trenches from caving in when ditching in very soft soil. The shields are usually about 8 ft. long, or sufficient to permit the tiles being laid properly. The machines vary in size and weight—from a machine capable of digging trenches 10 in. wide by $4\frac{1}{2}$ ft. deep and weighing 7 tons, to machines that will dig trenches 36 in. wide by $7\frac{1}{2}$ ft. deep, and weighing about 22 tons.

(a) *Wheel Excavator*.—Fig. 8 illustrates a machine used extensively by contractors for tile drainage on the farms of Ontario and Eastern Canada. The machine weighs about 7 tons; its length over all is 25 ft., and its width over all is 8 ft. 6 in. The power is supplied by an internal combustion 14-h.p. single-cylinder engine. The digging is done by buckets on the rim of a wheel which is revolved in the trench: as each bucket reaches the top of the circle, the soil falls upon a conveyer belt: the belt can be adjusted to deposit on either side of the trench. Cleaning devices are furnished to remove sticky earth from the buckets. Digging wheels are supplied to take buckets in sizes from $11\frac{1}{2}$ to 14 in. wide and to dig $4\frac{1}{2}$ to $5\frac{1}{2}$ ft. deep. Two men are required to operate the machine and to lay and blind* the tile. The fuel required for ordinary tile drains averaging 3 ft. deep and 12 in. wide is 5 to 8 gal. of petrol per 10-hour day. Upon this class of work the machine will do 80 to 200 rods a day, depending principally upon the nature of the soil. The cost of this machine is about £750.

(b) *Endless Chain Excavator*.—Fig. 9 shows a machine of the endless chain elevator class. Machines of this kind are built in a greater range of sizes, so far as chain and buckets are concerned, than wheel excavators of the same weight. They also seem to be better adapted for work where there is need of 14 in. and larger tiles, and generally where there is a heavier task to perform. The digging apparatus (Fig. 10) is operated

* *i.e.* to fill in sufficient earth to hold the tile in place.

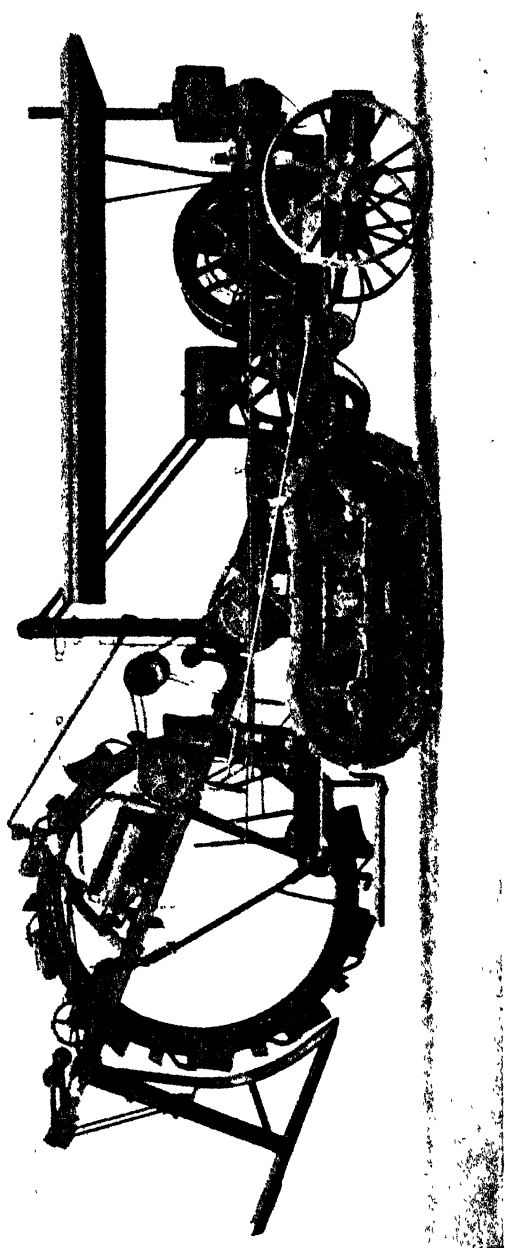


FIG. 8.—Buckeye No. 1 Wheel Excavator.



FIG. 9.—Austin Farm Tile Trenching Machine.

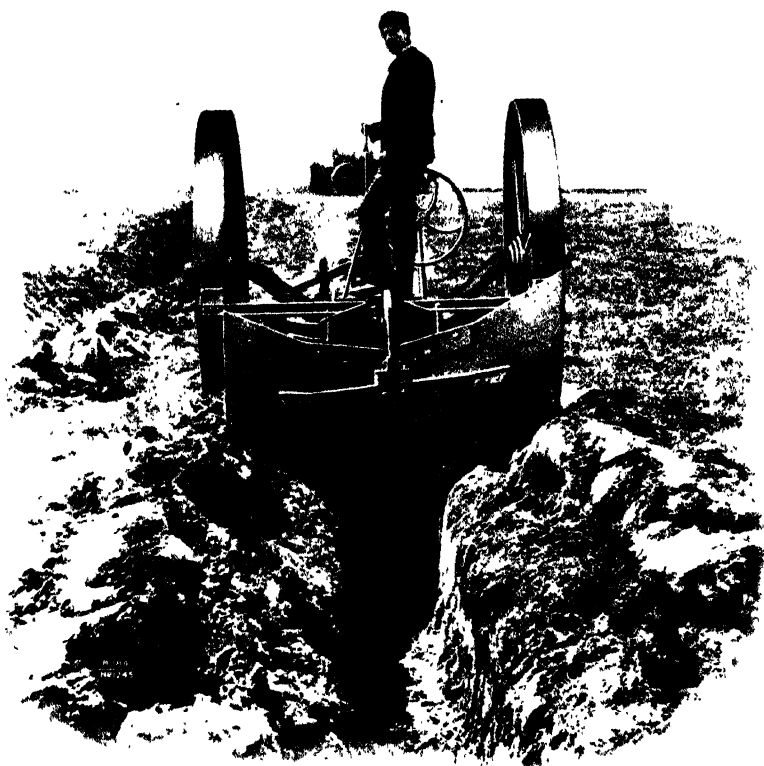


FIG. 12.—Fowler Trenching Machine at Work.

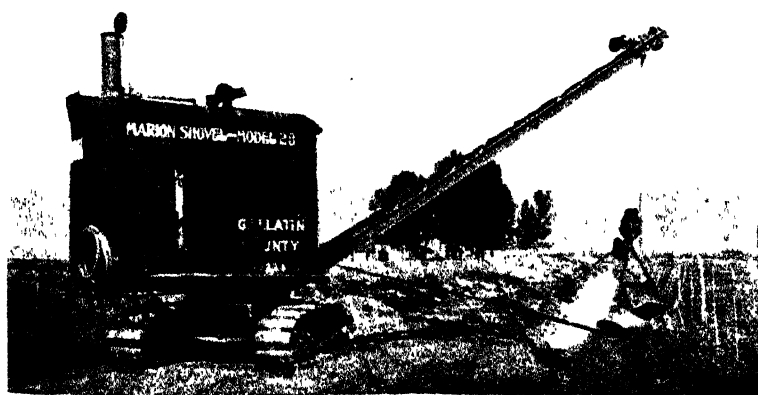


FIG. 13.—Marion Model 28. Drag-line.

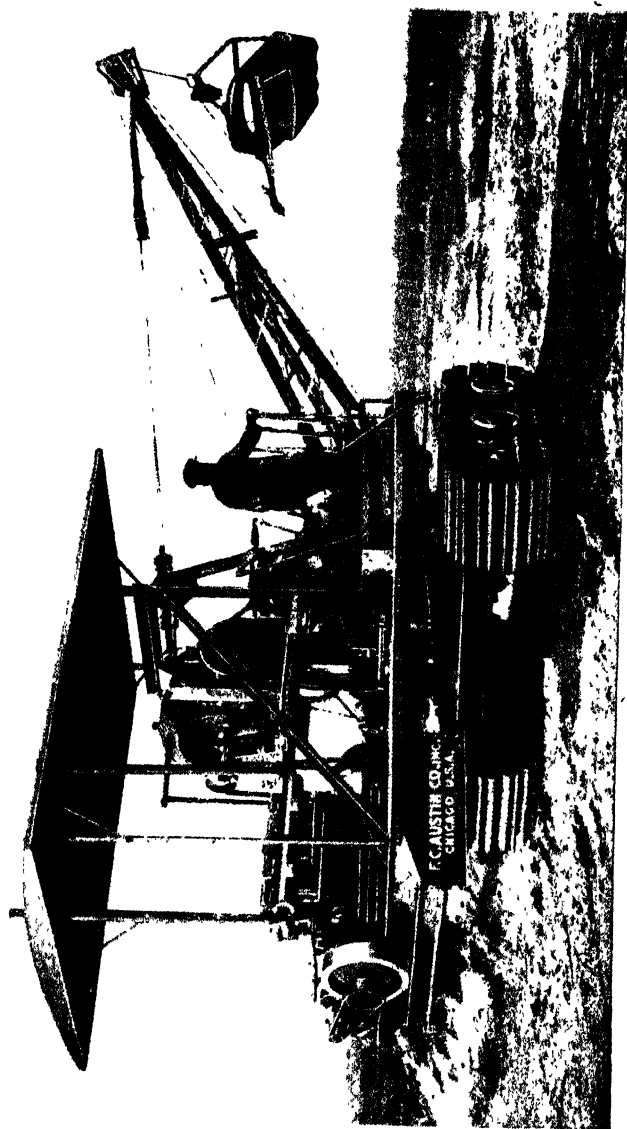


FIG. 14.—Austin Model 5 Drag-Line equipped with 30-ft. Boom, $\frac{1}{4}$ -yard Bucket.

by a sprocket wheel at the upper end of the frame, receiving power through a drive chain from the engine. At the end of their upward movement the buckets empty their loads upon an endless belt, which conveys the soil far enough to the side, so that it will not fall back into the trench. Cutting knives or teeth on the lip of the bucket are often used in hard ground. An attachment is also manufactured that will cut open ditches with a sloping bank, having a maximum depth of 5 ft. and width of $7\frac{1}{2}$ ft. Devices for cleaning buckets are attached to the machine. The machine illustrated in Fig. 9 weighs about 13 tons: its length over all is 33 ft. plus boom 18 ft.; its width over all is 9 ft. 4 in.; and its height over all is 10 ft.

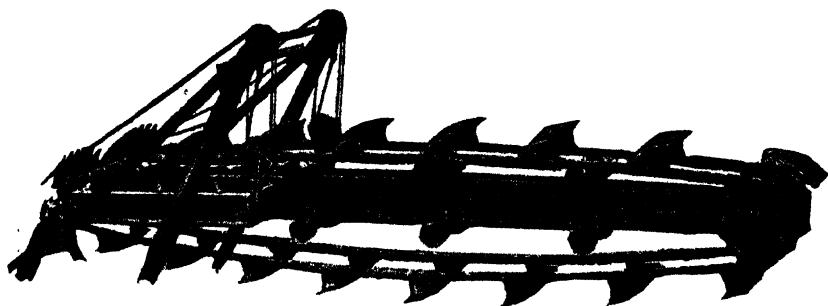


FIG. 10.—Endless Chain Excavator—Digging Apparatus (for larger machine than Fig. 9).

The power is supplied by an internal combustion 4-cylinder engine rated at 22 to 25 h.p. Two men are required to operate the machine, to lay and blind the tile. The fuel required for tile drains averaging 3 ft. deep and 12 in. wide is 20 gal. of petrol per 10-hour day: the minimum amount of work done per day is about 300 yards.

3. **Steam Tackle.**—Steam tackle is too well known to need description. Mole drainage and open ditching have been successfully practised by this system for many years, and very suitable implements are provided for that purpose.

(a) *Mole Draining Machines.*—Mole ploughs (Fig. 11) are used to form channels in the subsoil to drain the land. The machine forms a duct with smooth sides (similar to a mole track) into which the surface water drains and is carried away to the main drain. Stiff, clay soils are best suited to this method of drainage, since there is less likelihood of the soil filling the channels and blocking the water than in the case of loose soil. Land lying on a fair incline gives better results than flat land, as the rapid flow of the water tends to keep the

channel open. The plough consists of a steel cone carried on a coulter attached to a stout beam. The frame of the machine is mounted on two large hind wheels and one or two smaller wheels in front. Means are provided for regulating the depth of the bore to a maximum of 3 ft.

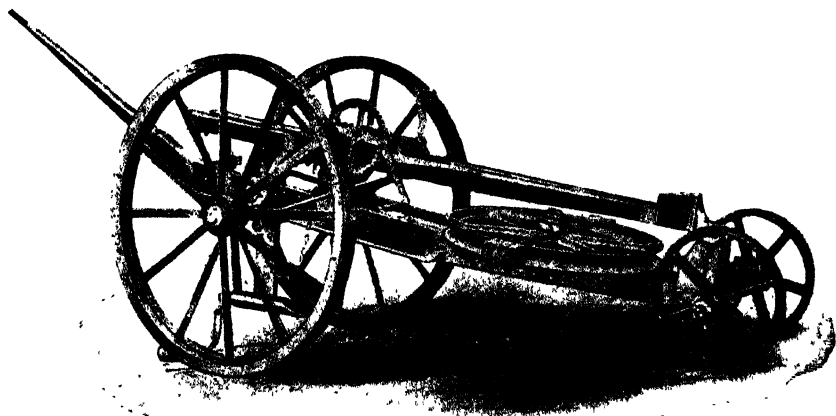


FIG. 11.—Fowler Double-frame Mole Draining Machine, fitted with Hand Lifting Gear.

(b) *Trench or Ditching Machines.*—Fig. 12 shows an example of a Fowler implement of a type little used in this country. It is designed for opening trench or irrigation ditches. The front of the frame is provided with a rope sheave round which a rope from one of the ploughing engines passes, the other end of the rope being fixed to the hind wheel of the same engine. The front coulter splits the mass of earth to be removed into two halves, which are conveyed upwards by suitable mould-boards and deposited on both sides of the finished ditch. The machine is manufactured in several sizes, making trenches up to 2 ft. in depth and 3 ft. in width.

4. **Scraper Excavators with Drag Lines.**—These machines are designed for open ditching work and are specially useful in digging by lateral excavation ditches not exceeding 16 ft. over the top. By substituting additional booms the machines can be converted to do four different kinds of work :—

- (a) Drag line work.
- (b) Digging and steam shovel work.
- (c) Grab work with slush.
- (d) Grading work.

The power unit of these machines may be either internal combustion or steam. The class of work undertaken by these

types is very heavy, and steam power is advocated wherever coal is procurable. The swinging boom is mounted on a bed frame and the upper end of the boom is supported by a cable. The bucket or scoop hangs on a cable from the upper end of the boom and is filled by being dragged along the ditch. The loaded bucket is raised by a cable from the boom, which then dumps it on the waste bank.

Figs. 13 and 14 show two types of drag-line machine, the first driven by steam and the second by an internal combustion engine. The first is the "Marion" Model No. 28. This is equipped with a 32-ft. boom, weighs about 21 tons, and will cut from 200 to 400 cubic yards of soil a day. The multipedal tracks are 5 ft. 8 in. by 2 ft. One ton of coal is required a day. The second is the "Austin" Combination No. 5, which has a 4-cylinder engine of 45 h.p. requiring 30 gal. of paraffin a day. It has a boom length of 30 ft., weighs 17 tons, and will cut a minimum of 300 cubic yards a day. Both machines require two men to operate them. The cost of the former is about £2,500 and the latter £2,750.

Conclusion.—It has already been indicated that only the very large farmer can afford to buy a machine other than one of those in the first class described above. There would appear to be ample scope for local authorities (such as Drainage Boards) and for contractors in carrying out by mechanical means the various classes of drainage work requiring to be done. In this connection it may be of interest to set out briefly a scheme in operation in parts of Canada where drainage machinery is largely used.

The actual work is undertaken by contractors, but the Provincial Departments of Agriculture assist farmers and contractors in the following way. Provincial Drainage Officers get the farmers together in a district which needs draining, and endeavour to secure an undertaking from them to proceed with the work, with the object of arranging for sufficient work to make it worth the while of a contractor to come into the district. Clearly a contractor cannot pay his expenses if the only work in prospect is an odd field here and there. Drainage Advisers are sent during the summer months to farmers who desire to have their farms drained, and who require technical assistance in preparing plans, etc. The Adviser surveys the farm, prepares a scheme and advises the farmers generally on the best methods to be adopted. No charge is made for the services of the Adviser, but the farmer pays his travelling expenses, defrays the carriage of his implements, boards him while af

work, and furnishes any necessary information. Loans are granted by the Provincial Government to any farmer requiring financial assistance to enable him to put in a system of tile drains. Such loans are repaid in the form of an addition to the Land Tax.

Although such a scheme may not be applicable to the conditions in England and Wales, yet it appears to the writer that there is a paramount necessity for mapping out the work to be done, and for so organising it that it will be efficiently and cheaply performed either by contractors or public authorities. At the same time it is desirable to give a word of warning: the conditions which have to be faced in any country or in any area are complex, and differ from those in other countries and other areas: the machinery suitable for a new country will not necessarily prove suitable for an old one. Careful investigation and experiment are an essential preliminary before any particular types of machines can be recommended for the various classes of work requiring to be carried out in this country.

LAND DRAINAGE.

IT is now possible to review the land drainage work which was commenced under the Defence of the Realm Regulations and is being continued under the provisions of the Land Drainage Act of 1918, with a view to increasing the food-producing capacity of the country by means of the improvement of the rivers and arterial drains. "Land drainage" must be distinguished on the one hand from "farm drainage," which, though it depends for its full effectiveness upon the efficiency of the rivers and main arteries, involves entirely different administrative and technical questions, and, on the other hand, from works of "land reclamation" which have for their object the making of agricultural land out of tidal marsh, heath, bog, or other waste areas.

Under the Defence of the Realm Regulations power was given to the Ministry of Agriculture to enforce the liability of any riparian occupier of agricultural land to clear any watercourse in or adjoining his land, in cases where his neglect to do so rendered other land liable to be damaged by flooding.

Further power was given to the Ministry to take over and exercise any drainage powers which were being ignored, or inadequately exercised, by any drainage authority. These powers were exercised by the Ministry through the Agricultural Executive Committees or counties, who dealt with the matter

on broad lines and organised comprehensive schemes for the improvement of whole rivers and large areas of land.

The cost of the work done under the Regulations was either met voluntarily by the riparian owners or occupiers themselves in the first instance, or, where the work was carried out by the Executive Committees, was advanced by the Ministry, to be recovered from the riparian occupiers on the completion of the work. To obviate the injustice of compelling a riparian occupier or owner to pay for work which benefited other land besides his own, all such work, if it could not be paid for out of the rates of a drainage authority, was done by prisoner labour, which was given free. The official action of county committees under the Regulations naturally aroused widespread interest in land drainage, and led to a vast amount of voluntary work being done by landowners. A return rendered recently to the Ministry by county committees shows that the acreage which has been benefited by drainage work done by or at the instance of County Executive Committees reaches the substantial total of 405,500 acres in England and Wales. The advances made by the Ministry of Agriculture to pay for the work amounted approximately to £90,000, of which about £20,000 has been recovered. Owing to changes of tenancy and other causes, it may not be possible to recover the whole of the balance, but it is estimated that the ultimate cost to the State of the whole work will not exceed an average of 2s. per acre.

The return above referred to is a document of great interest, not only as showing the districts in which the greatest energy has been displayed, but as indicating the different nature of the problems with which the county committees had to deal. For example, in Norfolk nine schemes were carried out, and the total area benefited was 34,000 acres, an average of 8,500 acres for each scheme.* In Cumberland 10,000 acres were improved, but this involved the carrying out of no less than 99 separate schemes, of which 74 were carried out voluntarily by landowners, at the instance of the county committee, without any advance of money being made by the Ministry. Another typical scheme, of which some account may be of interest, was carried out in East Suffolk on the Dove. The length of river which was taken in hand was about 10 miles. The area drained by it is 20,000 acres, and the total cost of the work (the prisoner labour being free) was £1,050. The average width of the river

* An account of the work done in Norfolk on the River Waveney was published in this *Journal*, July, 1919, p. 381, and December, 1919, p. 922.

varies from about 12 ft. in the highest reaches to about 30 ft. in the lowest reach, but in places it was so badly silted up and overgrown that its course could only be traced with some difficulty. No constructive engineering works were attempted; it was simply a matter of digging, and of removing numberless old roots, fallen trees, and similar obstructions. The river, as improved by the clearances, should now be fully capable of carrying off all the water that drains into it. Very notable work has been done in Essex (89,000 acres), the West Riding (82,700 acres), and Lindsey (Lincs.) (44,700 acres).

It was of course clear from the beginning that the effect of the work carried out under war-time regulations would be only temporary, unless some statutory provision could be made for perpetuating it. Such provision has been made by the passing of the Land Drainage Act of 1918.*

Part I. of this Act enables drainage boards to be established, or the boundaries of existing drainage authorities to be altered, by an Order of the Ministry of Agriculture, which does not, unless it is opposed, require confirmation by Parliament; and such Orders can now be made by the Ministry either on its own initiative, or on receipt of a petition from persons or authorities intherested. Thus there is provided a short and inexpensive procedure, and a means of carrying out a considered and homogeneous policy with regard to all the drainage areas in the country.

Drainage authorities established before 1918 were either ancient Commissions of Sewers (some of them established as early as the thirteenth century), or authorities established by local Acts or under the Land Drainage Act, 1861. The former class have, generally speaking, a wide and indefinite area, and only exercise jurisdiction over parts of it. Authorities of the latter class have generally been established to meet purely local needs, and are the outcome of Parliamentary bargains. Their areas bear no relation, as a rule, to the requirements of the whole of the area drained by any river or artery. The policy adopted by the Ministry of Agriculture since 1918 has been to form drainage boards for whole river valleys or basins, wherever possible, which shall control the main channels and their banks, while retaining "internal drainage" authorities where these exist, and creating new authorities for internal drainage where desirable.

It may be of interest to set out the stages which have to be gone through, from the first proposal or petition for the forma-

* See this *Journal*, November, 1918, p. 961, and December, 1918, p. 1111.

tion of a drainage board, to the board's final establishment. The first stage is the making of a survey of the area concerned, in order to settle the boundaries of the proposed district. These boundaries are usually fixed at a line approximately 8 ft. above the highest recorded flood level. The boundaries are plotted on 6-in. Ordnance maps, and a draft Order is prepared which provides (where necessary) for differential rating, and for the representation on the board of the several component parts of the area. The draft Order and the map are discussed with the County Councils, existing drainage authorities, and other persons or bodies interested. When necessary, local conferences are held for this purpose. No Order can be made affecting the area of an existing authority without that authority's consent. The draft Order and map are then deposited for public inspection for a month, during which objections may be lodged with the Ministry of Agriculture. When the objections have been dealt with (a public inquiry being held if necessary), the Order receives any necessary revision, and is then sealed and again deposited for public inspection for a month, during which period persons having a prescribed interest may present memorials to the Ministry of Agriculture praying that the Order shall not become law without confirmation by Parliament. If no memorials be presented, or only such as can be met by slight alterations, the Order is confirmed by the Ministry and becomes law. Otherwise, it becomes a Provisional Order requiring confirmation by Parliament.

At the end of 1919 the Ministry had confirmed eight Orders establishing drainage authorities or extending their areas, and had in hand, at various stages, from the initial survey to the final deposit, 39 others. The total area affected by all these Orders (made or in course of preparation) is approximately 1,206,000 acres.

The Ministry are also enabled by Part I. of the Act of 1918 to extend the powers of drainage authorities constituted under local Acts. The local Acts frequently imposed limits of rates which make it impossible for the authority to carry on its work, having regard to the ruling prices of material and labour. But for this power to alter the local Acts it is probable that several small drainage districts would have become derelict during the past year. Ten Orders of this nature were confirmed in 1919.

The second part of the Act of 1918 confers two very useful powers upon the Ministry. The first is the power to take over

temporarily the duties of any drainage authority which is not carrying out those duties satisfactorily, and the second is to carry out schemes for the improvement of small areas of agricultural land by clearing or improving the watercourses. Both these powers are delegated by the Ministry to county committees established for the purpose. Schemes for the improvement of areas which are not suitable for administration by drainage boards are prepared by the county committees, approved by the Ministry, and deposited in draft for a month for public inspection. After any objections which may be made have been dealt with, the schemes are carried out by the county committees, the cost being advanced by the Ministry of Agriculture, and recovered from the owners of all lands benefited by the work. After the completion of the work, a county committee (acting as the Ministry's delegate) has the powers of a drainage board for the purpose of the maintenance of the works. The drainage of all the small detached areas in any county can thus be maintained by a single authority, instead of being either neglected or maintained by small local drainage boards which are necessarily uneconomical and have tended in the past to become inefficient. Schemes of this nature can be put into operation in places where there are ancient Awards which have fallen into abeyance on account of the vagueness of their terms or for want of any properly constituted authority to carry out their provisions.

The measures referred to above have led to a fairly general appreciation of the great harm which has been done to agriculture in the past by the neglect of the rivers and brooks throughout the country.* The damage does not arise only from actual floods, but arises to an even greater extent from the perpetual waterlogging which has rendered a great quantity of land entirely useless for corn-growing or for any of the deep-rooting crops, of which the value is now generally admitted. There is no doubt that much money has been wasted in the past by attempting to drain fields without providing an efficient outfall, and that the effect of much farm draining which was carried out years ago at great expense has been entirely lost through the outfalls having become choked. There seems now to be some ground for hope that the campaign which has been carried on during the last two years for the clearing of watercourses may result in widespread and permanent benefit to agriculture.

THE WHITE ROT DISEASE OF ONION BULBS.

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AND

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THE disease here described causes considerable damage to the onion crop, especially in market gardens and allotments. Until recently, however, it has not attracted serious attention, and, except in one isolated instance, it has never been the subject of scientific investigation. During the past two years the disease has been studied at the Ministry's Pathological Laboratory at Kew, and experimental work has been carried out in gardens and market gardens in that neighbourhood in which it had been found to occur. The fungus causing the disease has been isolated, grown artificially in pure culture, and the nature of its life-cycle determined. As a result of these studies the White Rot of onions has been clearly differentiated from certain diseases with which it has hitherto been confused by almost all writers. Furthermore, the fungus itself has been found to be quite distinct from two fungi (namely, *Sclerotinia bulborum* and *Botrytis cinerea*) both of which have, at one time or another, been regarded as the cause of the trouble in question, and to be identical with another parasite detected and described many years ago, but in more recent times almost entirely overlooked.

Now that the life-history of the causative organism is properly known it is possible to suggest methods for controlling the spread of the White Rot disease, although there is still room for further investigation in this direction, especially with regard to soil fungicides and trials as to the susceptibility and resistance of different varieties of onions.

The only previous account which deals in any way clearly with the White Rot disease is that* by the Italian botanist Voglino, who records its occurrence on garlic in various parts of Italy, and gives a description of the microscopic characters of the fungus. This being the case a fairly full general account of the disease and the fungus causing it is given below, though

* Le Stazioni sperimentati agrarie italiane, 1902. Vol. XXXVI. fasc. II., pp. 89-106.

technical details and other matter of purely scientific interest are omitted from the present paper.

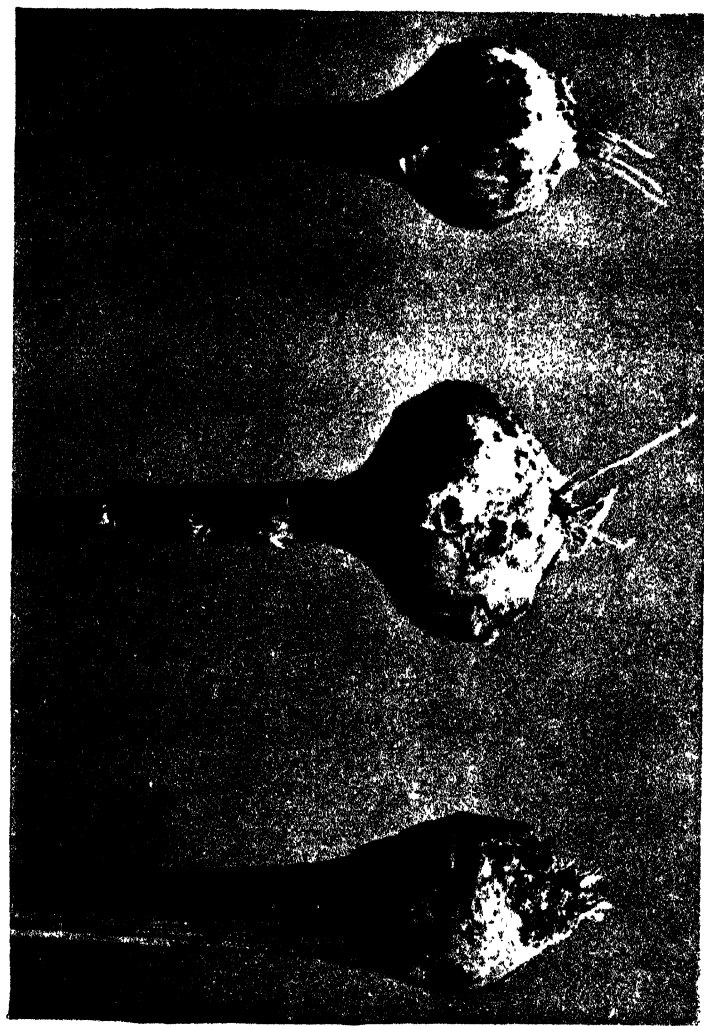
Historical.—The destruction of onion bulbs by a fungus producing a white mould was observed by Berkeley as long ago as 1841. He described the fungus and gave it the name of *Sclerotium cepivorum*.^{*} He states that the fungus is "very common on onions at the point from which the roots spring, and often very destructive." His description is meagre, it is true, but sufficient, nevertheless, to distinguish it from allied fungi. Berkeley's specimens, moreover, are preserved in the Herbarium at Kew; and examination of these shows that they are precisely identical with the White Rot fungus so prevalent to-day.

Since that date other forms of rotting in onion bulbs have been described, and great confusion has arisen as to the various diseases and also as to the fungi causing them. Much has been written, both in Britain and on the Continent, but with the exception of Voglino and a few quite recent writers, Berkeley's *S. cepivorum* has been more or less confused with the onion disease caused by Botrytis. No doubt the presence of the two fungi on one and the same bulb (as sometimes occurs late in the season) may partly account for this.

As a specific disease, quite distinct from Botrytis, White Rot was first correctly distinguished in this country in the Annual Report of the Plant Disease Survey of the Ministry of Agriculture for 1917 (p. 20). The popular name there employed was "Dry Rot," from the dry nature of the decay which the fungus produces. Since the term dry rot is usually associated with forms of decay occurring in storage, and as the present disease attacks the growing crops and seldom, if ever, causes trouble in storage, this term appears to be somewhat inappropriate. For this reason, therefore, another popular name, viz., "White Rot" (derived from the abundance of white mould at the base of diseased bulbs in the early stages) has been adopted, and the same name is employed in the Ministry's Plant Disease Survey Report for 1918. In Bedfordshire, where this disease is widespread, it is termed "Mouldy Nose," and in the north it is often, though erroneously, termed Mildew (see later, p. 1098).

Description of the Disease.—Onions become attacked with White Rot when the soil in which they are sown or planted is contaminated with the fungus. They usually first show symptoms of attack at the end of May or early in June. As might be expected in the case of a disease contracted from the

^{*} Ann. and Mag. Nat. Hist., VI., January, 1841, p. 359.



(a)

(b)

(c)

FIG. 1. —Autumn sown Onions affected with White Rot as seen in July. The destruction of the roots and the white mycelium on the bulbs is seen in specimens (b) and (c). Specimen (a) shows the formation of the small, black sclerotia at the base of the bulb.

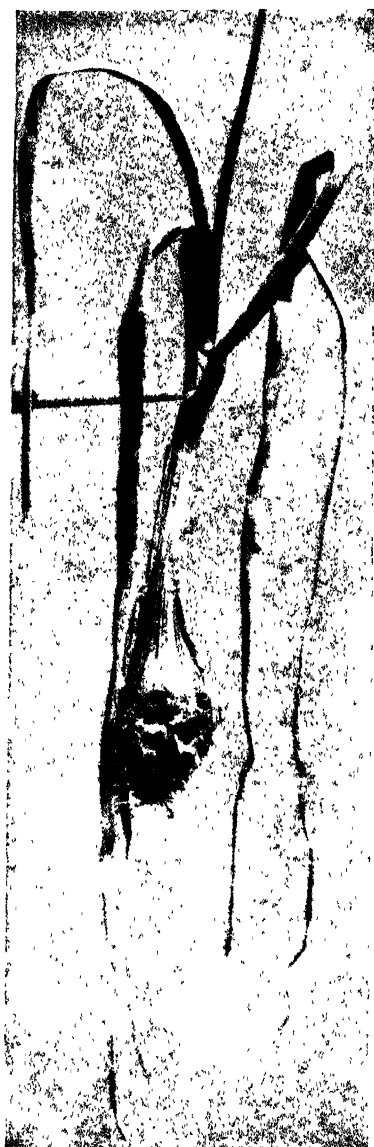


FIG. 2.

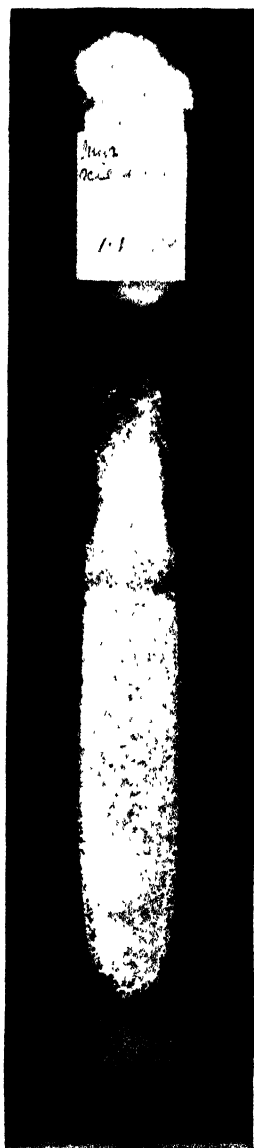


FIG. 3.

FIG. 2.—Spring-sown Onion Plant attacked by White Rot, showing the white mycelium around the base of the bulb.

FIG. 3.—A pure culture of the White Rot fungus grown on potato agar in a test tube. The culture is about a fortnight old, and shows the production of numerous black sclerotia amongst the white mycelium.

soil, the attack commences with individual plants located indiscriminately over the beds, but if the soil is heavily contaminated practically all the plants will be affected. Autumn-sown plants appear to be the earliest to suffer, but spring-sown onions suffer equally and, being smaller, are more quickly killed and are sometimes destroyed in large numbers.

The earliest visible symptom is one of wilting and yellowing of the foliage. The oldest leaves turn yellow and fall over, and later the other leaves also collapse. If the diseased plants are gently pulled they will be found to come up very readily, and closer examination will show that the roots have been invaded by fungus mycelium or spawn, and have been almost entirely destroyed (Figs. 1 and 2). It is probable that in all cases the roots are attacked before the bulb. Warm, damp weather appears to be specially favourable to the growth of the parasite, and when these conditions exist the fungus develops rapidly round the base of the bulb and soon covers it with a mass of fluffy white fungus-spawn or mycelium (Fig. 1 (c)). This white mycelium is very characteristic of the White Rot disease, and distinguishes it at once from all other diseases of the onion. When the disease is still further advanced it will be found that the fluffy mycelium has largely disappeared or has been replaced by a more closely fitting web which penetrates also into the tissues of the bulb (Fig. 1 (a)). At this stage the surface of the bulb shows the presence of numerous, black, spherical bodies about the size of small poppy seed (0.5 mm. diam.) and termed sclerotia. The sclerotia are the resting bodies of the fungus (corresponding in a rough way with seeds), and it is by means of these that the parasite persists in the soil from year to year. The fungal threads continue to penetrate the tissues of the bulb, devouring the cell-contents, and forming numerous sclerotia, until finally the bulb becomes shrunk and dried up. The sclerotia are produced in large numbers on the diseased plants, and it is obvious that if the bulbs are left in the ground the soil becomes thoroughly contaminated with the fungus.

White Rot is most in evidence from the beginning of June to early August. By August it has mostly killed or destroyed the affected plants, and comparatively few new infections appear to take place after that date.

Method of Reproduction and Over-wintering.—In order to combat the disease intelligently it is essential to know the life-history of the parasite and its methods of propagation and perpetuation.

Notwithstanding the most careful search during the last two years the only method of reproduction which has been observed is the germination of the above-described sclerotia. It has been found, by means of artificial cultures in test-tubes, that under suitable conditions of warmth and moisture these bodies put forth ordinary vegetative filaments which develop into a new growth of mycelium. The same method of germination, without doubt, takes place in the soil where the mycelium produced would invade the roots of any onion plants which were present. It would appear, therefore, that under natural conditions the sclerotia formed on the diseased bulbs in the summer remain dormant in the soil during winter, germinate in the late spring, and thus bring about the infection of the new crop.

Shortly after germination the mycelium of the fungus produces minute conidia or so-called microspores.* They are developed very freely in test-tube cultures, and were observed also on diseased onions grown under field conditions. All efforts to induce these conidia to germinate, however, failed. Similar conidia are found in certain related fungi, and these also have not been observed to germinate. Should they be capable of germination under the influence of such conditions as exist in the soil they would be of importance in that the fungus would be provided with another and partially aerial method of propagation.

In certain allied fungi (e.g., *Sclerotinia sclerotiorum* on potatoes, etc., *S. trifoliorum* on clover, and *S. bulborum* on hyacinths and other ornamental bulbs), stalked, cup-shaped bodies known as ascophores, producing spores which are actively discharged into the surrounding air, are developed from the sclerotia. These bodies have not been observed, or induced to develop, in the case of the onion fungus. In order to encourage their development the usual method of subjecting the sclerotia to artificial freezing, in this way simulating winter conditions, was repeatedly tried but without effect. It would appear, therefore, that the disease is not spread by air-borne spores, but solely through the agency of sclerotia.†

Another point of great practical importance is the length of time the sclerotia retain their vitality. It is impossible

* Voglino also described these bodies, but in spite of the most critical search no trace of the sphaelial stage described and figured by him as occurring on the sclerotia themselves was observed. Dr. G. H. Pethybridge informs us that this stage could not be detected in the material he examined in Ireland.

† It is for this reason that the authors prefer to retain Berkeley's generic name *Sclerotium* rather than to transfer the species to the ascomycetous genus *Sclerotinia*.

to make an exact statement as to this, since infected soil has not been long enough under examination. From accounts collected from market gardeners and others it would appear that the fungus persists in the soil for a considerable period, at least three or four years, and, judging by analogy with allied species, the sclerotia may survive considerably longer.

Method of Spread.—The introduction of the disease into new localities obviously takes place through such means as the distribution of soil containing sclerotia, the planting of diseased plants and sets, or through the careless disposal of contaminated refuse or manure. Local spread is probably chiefly accounted for through the use of contaminated manure and rubbish, or the scattering of affected soil. For the spreading over larger areas the distribution of diseased seedlings is no doubt mainly responsible. Seedling onions for planting are brought to market in quantities in April and May. These are often reared on infected land, and on more than one occasion the white mycelium of the White Rot has been noted on retail supplies. The diseased plants are distributed to gardens and allotments; and, though seedling plants probably produce but relatively few sclerotia, a sufficient number are developed to contaminate the soil, so that with subsequent crops of onions the tendency is for the disease to increase year by year. This is especially the case when onions are repeatedly grown in the same land, and very much less so when a long interval is allowed. The disease may also be spread by the use of slightly diseased "sets," when the attack is so slight as not materially to injure the bulb or to attract attention.

Susceptibility of Varieties and other Crops.—As far as the present observations go, most of the common varieties of onions appear to be subject to White Rot. Shallots, as a rule, are markedly resistant, and have been observed growing side by side with diseased onions, but remaining perfectly free from attack. On one occasion, however, shallots grown at Kew were affected and a number of bulbs were completely killed, and one other case of this crop being diseased has been observed. Leeks also do not appear to suffer as a rule, but two instances of slight attacks on leeks have been noted.

Distinctions between White Rot and other Diseases.—The effect of White Rot as seen in the foliage somewhat resembles an attack by the maggot of the Onion Fly. That disease, however, is distinguished by the presence of the maggots in the bulbs, and the absence of the white fungus mycelium and the black

sclerotia. The decay, moreover, is usually of the nature of a wet rather than a dry rot (see Leaflet No. 31.)

Of fungus diseases the most generally distributed is Mildew. This occurs as a whitish-lilac or grey mildew on the leaves, the bulb remaining free from attack (see Leaflet No. 178). Onion Smut, a recently introduced and serious disease, is distinguished by the presence of streaks of black spore-masses in the leaves and outer scales.*

The disease with which White Rot is most likely to be confused, except by expert mycologists, is that caused by the fungus named by the American botanist, M. T. Munn, *Botrytis allii*. In its typical form, however, the *Botrytis* disease is easy to distinguish by the fact that (1) it is the leaves and the top of the bulb rather than the roots and base of bulbs that suffer; (2) the mould which is present is grey and not white, and (3) the disease usually commences later in the year, namely, in late summer and autumn. *Botrytis* is particularly prevalent in wet seasons, and on poorly ripened bulbs. It is, indeed, often responsible for very serious losses in storage. *Botrytis* agrees with the White Rot fungus in producing sclerotia, but these are usually larger and flatter than in White Rot. Occasionally the two diseases are found in the same bulb. A full account of the *Botrytis* disease as it occurs in America has recently been published by M. T. Munn (New York Agric. Expt. Station (Geneva), Bull. 437, 1917).

Distribution of the Disease.—In England White Rot is very widespread, and is found especially in gardens, market gardens and allotments. In the Report of the Ministry of Agriculture's Plant Disease Survey for 1918 it is listed from 15 counties; it doubtless occurs in all parts of England. Mr. G. P. Berry, of the Ministry of Agriculture, has observed the disease near Edinburgh, and Dr. G. H. Pethybridge, of the Irish Department of Agriculture, states in a letter that it is plentiful around Dublin, but no published record exists of its occurrence in either of these countries. In some of the market gardens near London it is prevalent over extensive areas and causes much trouble, especially amongst spring onions. Near Manchester also it is said to cause very serious losses. From Voglino's account the disease is evidently serious in Italy, but owing to the confusion existing between White Rot and the *Botrytis* disease little is known as to its exact distribution on the Continent. No record appears to exist of its occurrence in America.

* See this *Journal*, May, 1919, pp. 162-174.

Methods of Control.—The only means at present known of exterminating White Rot, once it becomes established in any part of a garden or field, is by starving out the fungus from the soil. This can only be effected by keeping the ground free from onions and allied crops for a number of years. The exact length of time that is necessary cannot be stated, but judging by analogy eight or even ten years may not be too long. During this period the soil should be "worked" as much as possible, although the utmost care should be taken that contaminated soil is not conveyed to clean land. It would be advisable to make any new onion beds at a considerable distance from the infested land.

When once the bulbs become attacked practically nothing can be done to save them; the disease will gradually work through and destroy the whole bulb. As a general rule and when practicable the diseased plants should be removed as early as possible before the formation of sclerotia takes place. The plants should be carefully dug up, removed from the ground and burned. If this is persisted in during the entire season further infestation of the soil by sclerotia will be prevented.

In the case of small beds in private gardens and allotments when large bulbs are affected and the attack appears to be general it may even pay to lift the entire crop at once before the whole bed becomes infected. The healthy bulbs, being immature, should not be stored but put aside for immediate consumption; the diseased bulbs (or at any rate the diseased portions of them) should be burned at once.

Up to the present no success has been obtained with the use of soil fungicides, the hard coat of the sclerotia being probably as resistant to chemicals as the spores of the Potato Wart Disease.

No varieties of onions can be recommended at present as immune. Shallots are usually resistant, and leeks are not commonly affected. These crops might, therefore, in pressing cases be grown on infested land, but it would be preferable not to do so.

White Rot is not a disease which is liable to be introduced with the seed.

PEA AND OAT HAY.

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Need for the Crop.—If the return to grass of the newly-ploughed land is to be avoided, new methods of cropping must be introduced, as the addition made to the arable land during the War cannot be absorbed into the established farming system. The pre-war balance between winter and summer keep has been upset, and the area under root crops will be much too great if the new arable land is added to the existing system. This land has, in most cases, borne two crops of cereals, and it is undesirable that it should be cropped continuously with straw crops until its stored fertility is exhausted. At this period a mixture of peas and oats grown for hay should prove a valuable addition to the crops available to the farmer. If this mixture be grown on some of the newly-ploughed land which has carried two grain crops, the stock-carrying capacity of the farm can be maintained, and it is suggested that part of the grass land, usually mown, should be pastured, the loss of the hay crop being repaired by growing the hay required on the arable land. Further, in cases where the seeds plant failed last year the land might very profitably be sown, in spring, with the pea and oat mixture.

Soil suitable.—This crop can be grown on the poorest land, but the best yields are obtained on fairly strong land, low-lying moist soils giving better crops than the drier soils.

Sowing.—Early sowing is desirable, on dry soils. February is not too early, on average soils. March is the best month, and under any conditions the seed should be in the ground by the middle of April. On light soils the seed mixture should be sown broadcast and ploughed in about 3 in. deep, on heavier soils it should be broadcasted over the ploughing, and harrowed in with the spring-tined harrow, the land being rolled afterwards with a heavy roller. Broadcasting is preferable to drilling as it is equally effective and much less costly. The seed should be mixed at the rate of 2 bush. of oats to 1 bush. of peas, and the mixture should be sown at the rate of 3 to 4 bush. per acre.

Varieties suitable.—The large-seeded oats are quite unsuitable for this purpose, as the total weight of crop is much smaller than that of the straw-producing types, although their grain yield is heavier. Clemrotheray is the best variety of oats available for making into hay; it is very hardy, produces fine

long straw, grows very densely on the ground, and yields a large bulk. If this variety cannot be obtained, Sandy, Blainslie or Welsh Grey may be used. As regards peas, there is little to choose between the maple and dun varieties; if anything, the maple variety has the advantage. The effect of mixing is to increase considerably the growth of the oats; when oats are mixed with peas they may grow from 6 in. to 1 ft. taller than in the case of a pure oat crop.

Effect on the Soil.—The mixture, under suitable conditions, makes such a dense growth that practically no weeds can exist underneath the crop. The pea roots act as pulverisers of the soil, leaving it in particularly good condition to receive the following crop. The mixture could quite safely be grown several years in succession, as its character is such that the effect on the soil is quite different from that which results from growing of unmixed grain crop.

Manuring.—If the land is in poor condition a dressing of farmyard manure should be given, if possible, but on land which has recently been in grass no such application is necessary. The yield will, however, be considerably increased if, at the time of sowing, a dressing of from 3 to 5 cwt. of superphosphate per acre is given. Top-dressing the crop with nitrate of soda is effective in increasing the yield, but very little benefit is found to result from applications of sulphate of ammonia.

Harvesting and Stacking.—Many farmers who have grown this crop have cut it much too early, and in consequence have lost a considerable percentage of the possible yield. The correct time for cutting is when pods have formed on the peas but have not become filled with seeds. The oats are at this time—when Clemrotheray is grown—in the milk stage. Some difficulty in cutting the crop may be experienced on account of its great weight and length, and it will be necessary for a man to follow the mowing machine with a fork in order to clear the path. After the cutting operation the swaths should lie undisturbed until the surface is well dried; they should then be turned with a hay turner and again be allowed to dry, and afterwards made into large cocks. Some care is necessary in making the cocks, as the straw is very long and difficult to handle. It is not easy to form the heaps in a neat manner. Ordinary hay is most effectively cocked with the hand rake, but the pea and oat mixture can only be satisfactorily handled with a fork. Every cock should consist of at least two forkfuls of hay, the size of the heap depending on the dryness of the crop. Care must be taken to see that the straw lies in the cock as near as possible

horizontally, and that each cock is trimmed free from all loose straw. If much of the heap is composed of straw standing vertically the cock will tend to split open and so enable rain to pass right through. Peas and oats need different treatment in the making from other kinds of hay, in order to secure the best results. Such hay is not easily spoiled by bad weather in the early stages of making, but, as in the case of all other kinds, if long exposed to rain after the sap has gone from the stems, it will be seriously injured. It should be allowed to cure in the cocks for a considerable time, and it may be advisable to put two cocks into one to complete the curing process. Meadow hay may be improved by heating mildly in the stack, but pea and oat hay should not heat at all. It should be completely cured before being stacked, and it is of the greatest importance that it should be quite free from rain-water, otherwise the peas will become mouldy. The stacks must be thatched as soon as possible, as the open nature of the hay readily admits rain into the interior, and much harm to the produce may result.

Feeding.—Pea and oat hay is very nutritious, containing the materials that would have gone to form the highly nutritious seeds of the crop if ripening had been permitted, and in practice it is found to be a better food than meadow hay. It should not be expected, however, that such hay will eliminate the need for the feeding of concentrated foods. Pea and oat hay may be chaffed and used to improve inferior fodder, or it may be fed uncut; but animals which have been accustomed to feed on cut chaff and roots will, at first, leave a quantity of the rougher part of the oat straw. From 7 to 14 lb. may be fed per day. The hay is excellent for feeding with large quantities of roots, as it counteracts the tendency to scour caused by the excessive feeding of succulent fodder.

Yields.—When suitable varieties are grown heavy yields are obtained. On average soils the yield should be about 3 tons per acre, while even poor soils should give 2 tons per acre.

THE following tables and notes embody the results of tests made at the Official Seed Testing Station from 1st August, 1919, to about the middle of January, 1920. The publication of these results should serve to indicate to growers the probable quality of the seed available for sowing this season. In the tables the average figures for the previous year are given for purposes of comparison:—

**The Quality of
Farm and Garden
Seeds.**

TABLE SHOWING THE QUALITY OF CLOVER AND GRASS SEED.

Kinds of Seed.	No. of Samples on which Average is based.	Percentage—Germination (a) and Hard Seed (b).		Percentage Purity.	
		1919-1920.	1918-1919.	1919-1920.	1918-1919.
		(a) (b)	(a) (b)		
Red Clover ..	500	83.3, 4.9	81.1; 4.5	95.7	95.9
Alsike Clover ..	120	78.5; 10.0	84.0, 7.5	94.5	96.5
White Clover ..	180	73.6; 8.9	76.5, 7.2	94.2	91.7
Wild White Clover	50	74.2, 12.5	74.0; 12.1	85.3	85.1
Trefoil ..	150	80.2; 2.9	67.2, 2.6	98.8	98.1
Lucerne ..	36	86.2, 5.5	87.2, 4.7	97.7	97.7
Crimson Clover ..	100	90.2; trace	87.1, .2	97.0	95.8
Perennial Rye-grass ..	200	84.4, —	82.7, —	97.9	97.6
Italian Rye-grass	250	85.5, —	82.4; —	98.6	97.9
Cockstoot ..	80	82.1; —	78.0, —	97.3	97.1
Timothy ..	60	92.2, —	88.8; —	99.0	98.7
Meadow Fescue ..	50	84.3; —	84.5; —	98.2	98.1
Dogstail ..	30	59.9, —	70.2; —	98.1	97.4

TABLE SHOWING THE QUALITY OF CEREAL, ROOT AND VEGETABLE SEED.

Kinds of Seed.	No. of Samples on which Average is based.	Standard of Germination Specified in Testing of Seeds Order.	Germination] per Cent.	
			1919-1920.	1918-1919.]
	1919-1920.	Per Cent.		
Wheat ..	924	90	96.2	97.3
Barley ..	118	90	96.2	95.7
Oats ..	480	85	95.7	95.1
Rye ..	60	80	92.4	96.5
Turnip ..	250	Field, 75. Garden, 70.	90.9	88.8
Swede ..	150	75	82.7	84.9
Rape ..	16	80	83.2	83.0
Kale ..	100	Field, 70. Garden, 65.	79.7	77.4
Cabbage ..	400	Field, 70. Garden, 65.	78.6	75.8
Brussels Sprouts	90	65	78.5	84.3
Cauliflower and Broccoli ..	300	Cauliflower, 60. Broccoli, 65. }	75.8	75.1
Peas ..	750	65	84.7	78.7
Vetches ..	150	90	93.8	92.7
Mangold ..	350	120	123.5	125.7
Beet ..	300	90	120.8	109.2
Parsnip ..	100	40	67.8	63.8
Carrot ..	300	50	68.7	64.4
Onion ..	600	55	71.1	75.2

The figures indicate that good quality seed of most crops is obtainable, though stocks are doubtless very short in some cases. In nearly all cases seeds harvested in the British Isles are showing higher germination than in the previous year. The fine weather experienced in the late summer no doubt largely accounts for this. Another factor, the full influence of which it is not easy for the Seed Testing Station to estimate, is the amount of seed held over from the previous season. The germination of such held-over seed may not deteriorate very greatly in most cases, provided the seed has been stored under favourable conditions, yet the presence of large held-over stocks always seems to lower the average germination more than would be expected. It is probable that such stocks are this year very small, except in the case of some of the vegetable seeds.

In the case of most of the cereal, pulse and vegetable seeds there is no very great difference between the two seasons' figures. Beet, however, shows an increase of 11 per cent., and reaches a figure almost as high as that of mangolds. The growth of the latter seed is rather disappointing, as it was expected that last year's average would have been improved upon. Peas show an improvement of 6 per cent., which may probably be increased when the whole of the season's results are averaged.

Among the clovers the outstanding feature is an increase of 13 per cent. in the germination of trefoil. There are some exceptionally good samples of this seed procurable this season.

Red clover shows the slight increase of 2 per cent., but the improvement in the growth of English seed this season is probably greater than this. There is a marked decrease in the amount of dodder found. Last season seeds of this weed occurred in 27.3 per cent. of red clover samples, whereas the corresponding figure this season is 21.2 per cent.

Alsike does not appear to be of quite such good quality as usual, both purity and germination being lower.

All the grasses, with the exception of crested dogstail, show improved figures. Though only a comparatively few samples of this seed have yet been tested, it appears that much of the new seed is of poor growth. Italian rye-grass shows a slightly higher germination than perennial rye-grass.

Farmers, allotment holders and others desiring to send seeds to the Station to be tested should comply with the following regulations :—

1. *The Weight of Seed* sent must be as follows:—Broad beans and Scarlet Runner beans, 8 oz.; peas and dwarf French beans, 6 oz.; wheat, barley, oats, rye, vetches, red clover, crimson clover, trefoil, lucerne, and sainfoin, 4 oz.; all grasses, alsike clover, white clover, all roots, beet and mangold, 2 oz.; all vegetable seeds, other than beet and mangold, $\frac{1}{2}$ oz.
2. *Fees* must be sent at the same time as the sample. The fees are as follows: (a) In the case of tests which a farmer requires for his own information only, 3d. per sample; (b) in the case of tests needed for the purpose of a declaration for sale, 1s. per sample for cereals, 1s. 6d. per sample for roots, vegetables and vetches, and 2s. per sample for grasses, clovers, mangold and beet. Postage need not be prepaid when packages are properly addressed and sent by letter post.
3. *Packages* should be addressed to: The Director, Seed Testing Station, Ministry of Agriculture and Fisheries, 18, Leigham Court Road, Streatham Hill, S.W. 16.
4. *Special envelopes* may be obtained by farmers, free of cost, on application to the above address.

Mechanical Pressure Silage.—In 1913 Samarani published an account* of experiments with artificially weighted silage made in containers. The pressure, at first obtained with weights (about 5–6 cwt. per square yard), applied immediately after filling, was in subsequent experiments obtained by means of a screw press. From these latter experiments the writer draws the following among other conclusions:—

(1) That as a result of the greatest possible exclusion of air "a check is given to the intercellular fermentation which tends to produce acetic acid through the formation of alcohol, and thus a larger quantity of saccharine matter is left at the disposal of the lactic acid fermentation, with an enhanced acid production."

(2) That silage so prepared, being poorer in acetic and butyric acids, provides forage of a less intense odour than ordinary sour silage.

He supports his conclusions by numerous analyses. In these experiments the thermometer during the first ten days never rose higher than 23° C. (74° F.), having recorded 19° C. (67° F.) on the day of filling. Any rise of temperature, says the writer, should be checked by the exertion of greater pressure. It is in this possibility of graduated pressure that the advantage of the screw press lies.

* Samarani: Studi intorno alla conservazione dei foraggi allo stato verde. (Boll. del Ministero di Agricoltura, etc., Italy, Aug.–Dec., 1913, pp. 87–103.)

The method described by Wirz* in 1918 and Wenckstern† in 1919, though requiring similar apparatus, is quite different in principle. It is a method of producing sweet silage under pressure that has lately come much into vogue in Switzerland. The system generally adopted, though numerous modifications are in use, is that of the Herba Co., Rapperswil. As regards Wirz, the chief point of interest is that he traces the progress of the movement from the stack silo to the container. He is not, however, very explicit as to the methods adopted in the latter process. From Wenckstern, however, we learn that the silos, which are erected under cover, should not be more than about 15 ft. high by about 14 ft. square, with a capacity of about 3,000 cubic ft. The corners inside are rounded. The press has a pressure of about 8 to 10 cwt. per square yard, sometimes as much as 16 cwt. being applied with good results.

The most explicit directions are given as to every stage in the process. The grass must be wilted but not really dry, though dry enough to exude no moisture when twisted in the hand; the correct moisture content is about 74 per cent. The wilted grass must be loosely spread in the silo, about 1½ to 2 yards deep at a time, and allowed to rise quickly to a temperature of 50° to 60° C. (122° to 140° F.); the temperature must then be checked by compression either by means of a fresh layer or with the press. The material must never at any time be trodden; when pressed there must be no interstices or hollows in any part of the mass. The reasons given for these directions are that the slight drying of the grass assists loose layering, which in turn admits air and oxygen, thus inducing plant respiration which leads to rapid heating. Acetic acid fermentation is active between the temperatures of 18° and 35° C. (65° and 95° F.) and is quite checked at 50° C. (122° F.). Butyric acid fermentation is most active between 35° and 37° C. (95° and 99° F.) and ceases at the latter temperature. Lactic acid fermentation begins at from 30° to 35° C. and can go on after 50° C. (122° F.) is reached. This, then, is the right stage at which to check any further development and to secure the lactic acid described by Wenckstern as "the farmer's friend." The impression left after reading the directions is that the success of the system depends on too many minute observances—too much thermometer reading and sampling by taste and smell. The system, as Wenckstern suggests, is more likely to be used

* Wirz: *Das Süsstutterbereitung*.—Zürich, 1918.

† Wenckstern: *Das neue Süsspressfutter verfahren in Silos mit Selbsttätiger Pressvorrichtung*.—Berlin, 1919.

by the small holder, who would attend personally to all the details, and for whom also it is adapted as allowing of the conservation of small quantities of fodder. Doubts are raised as to the suitability of this silage for meat and cheese production. Wenckstern gives numerous analyses both of acid contents and statements as to feeding value. The books of Wirz and Wenckstern are both usefully illustrated.

Economic Results of Drainage.—In a small volume by Grünert* most interesting figures are given as to the economic results of drainage systems in various parts of Germany and Austria. The following average percentage increases in crop production are calculated on the basis of returns from drained lands in Germany, Bohemia and Moravia: Wheat, 40-81; Oats, 44-45; Barley, 41-64; Clover, 30-100; Sugar beet, 80-136; Potatoes, 90-180.

Average increased returns for the 10 years, 1905-1914, from drainage on twenty-two estates in the Rhine Province are as follows:—

Crop.			lb. per acre.		Increase per cent.
Rye	..	..	435	..	37
Oats	..	..	670	..	42
Wheat	..	..	535	..	30
Potatoes	..	..	3,560	..	50

The average percentage increase is 40 per cent. estimated at a value (on German pre-war prices) of 46s. 6d. per acre.

In the thirty years 1887-1917 the average increases in yields attributable to drainage in the Archduchy of Austria are worked out in a publication of the Lower-Austrian Land Committee as follows:—

Cereals	..	..	..	803 lb. per acre.
Potatoes	..	..	..	2,677 " "
Roots	..	..	..	11,600 " "
Hay	..	..	..	2,231 " "
Straw	..	..	..	1,249 " "

The writer directs attention to the figures for roots and to the increased yield of straw.

Agricultural Costings.—Results of the Danish Costings Bureau for the second year (1917-18) have now been published.† They are based on a total of 235 accounts, 182 of which were available for the first time for the year in question. As regards the pig industry the report points out that the state of affairs brought about by the introduction in February, 1917, of unrestricted U-boat warfare culminated in the summer of that

* Grünert: *Anleitung zur Drainage*.—Berlin, 1919.

† Denmark: *Undersøgelser over Landbrugets Driftsforhold II, 1917-18.*

year in an almost national catastrophe. An analysis of accounts furnished by 158 pig keepers bears out this comment. The average takings on an average fat pig were 149 kroner (roughly £8) and the average expense 168 kroner (roughly £9), thus leaving an average deficit of 19 kroner (or, say, £1).†

An interesting table is given showing the average deficit in the 158 holdings grouped according to size. From this it appears that in holdings under 25 acres the average amount of food needed to produce an average fat pig was 477 "food units" (a "food unit" is taken as roughly equal to a kilo, or 2·2 lb., of concentrated food), and the deficit was 7 kroner (or, say, 7s. 6d.) per pig. In the next four groups—ranging from over 25 to under 250 acres—the average amount fed was 551 "food units" and the average deficit 19 kroner (say, £1), corresponding more or less with the total average. On the group of large farms, however, of over 250 acres, the amount fed was 614 "food units" and the loss 40 kroner, or rather over £2. "These results," the report states, "may be regarded as emphasising the importance of the care and attention which pigs usually receive on small holdings, as a result of which the consumption of food per lb. of live-weight increase is reduced."

Another significant set of figures deals with the question of horse labour on farms of various sizes. The table is as follows, with substitution of English equivalents:—

Size of Holdings.	No. of Holdings.	Working Hours per Working Horse.	Food Units per Horse.	Cost of Horse Labour.		
				Per Working Hour.	Per Acre.	Per Working Horse per Year.
				s. d.	s. d.	s.
Under 25 acres	10	609	1,675	0 9·3	49 7	442
25- 50 "	29	1,097	2,394	0 8·1	40 0	665*
50- 75 "	43	1,274	2,579	0 7·6	44 8	565*
75-125 "	48	1,377	2,711	0 8·4	46 6	696
125-250 "	17	1,527	2,712	0 8·2	45 7	944
Over 250 "	9	1,825	3,111	0 7·7	42 4	1,104

On this table the report comments: "The most noticeable points are the working hours and the consumption of food per horse in the various groups . . . with increasing size of holdings the working hours increase, so that on the largest

* There appears to be some misprint in the original, with one or both of these figures. Possibly they should be transposed.

† Normal rate of exchange.

they are three times as long as on the smallest holdings. Consumption of fodder per horse is nearly twice as great on the large as on the small holdings. As against this the costs per working hour and per acre ("hectare" in original) are heaviest in the smallest holdings, but the difference is not nearly so great as might be expected, owing to some extent to the fact that on small holdings ponies, which are considerably cheaper to keep, are employed, and also because the land in the small-holder group is, taken all through, of a somewhat lighter character. . . . The total cost per horse per year increases with absolute regularity from group 1 to group 6; this is due to the increase in food consumed, which again is the result partly of the increasing size of the horses and partly of the increased number of working hours per horse."

Time for Spring Dressings.—It is now time to begin the application of spring dressings to the winter corn crops. Sulphate of ammonia can go on wherever the land is

Notes on Manures in suitable condition for the distribution,
for March: but nitrate of soda need not be applied

From the Rothamsted Experimental Station. for another month or six weeks if circumstances compel delay. Owing to the favourable conditions at the time of sowing and the dryness of the winter, the corn is in better condition than usual, and there was less washing out of nitrate than appeared likely during the wet month of December. Consequently, the need for spring dressings is less than it might have been, and probably in few cases will more than 1 cwt. per acre of nitrate of soda or sulphate of ammonia be given, even to a second corn crop. Corn following roots fed off or clover ley ploughed in last autumn is not likely to need anything this year.

Lime on heavy Soils.—It is generally found that on heavy soils lime gives better results on arable land than almost any other manure, but it does not produce nearly such striking results on the grass land, where it is much out-distanced by basic slag. Farmers on heavy land with only a limited amount of lime or ground limestone will therefore be better advised to use it on their arable rather than on their grass land. It can still be applied to land which is being prepared for roots.

Use of Gas Lime.—A correspondent asks if he can safely use gas lime on his soil. This course would have been perfectly safe in the autumn or early winter, but it is rather risky now, especially if the sample smells strongly. Really evil-smelling gas lime is a potent insecticide which can be used with considerable effect in a pest-ridden field. It is also, however, poisonous to crops, and the effect takes some time to wear off, although it disappears in the course of a few weeks.

Use of Broken Straw or Dust from threshing on Grass Land.—During threshing there is a certain amount of broken straw, cavings, dust, etc., which can hardly go into the yards because it contains arable weed seeds and is, therefore, sometimes carried on to the grass land. If the distance is not great this may be worth doing, but the material is not really very good and does not justify any great expense in carting. At Rothamsted the effect of chopped wheat straw on grass land was studied for a number of years. Applied at the rate of nearly one ton per acre, along with artificial manures, it gave increases varying from 3 to 10 cwt. of hay per acre on the plots receiving artificials only. The results were :—

Average Yield of Hay. Cwt. per Acre.

	1856-65.	1866-75.	1876-97.
Artificials only	53½	.. 48½	.. 58½
Artificials + 2,000 lb. chopped wheat straw.	55½	.. 59½	.. 67½

For the first ten years the results were hardly worth the labour involved, though subsequent effects were more marked.

The Use of City Refuse as Fertiliser.—During the War numerous attempts were made to utilise city refuse as fertiliser, and dumps located in various districts were carefully examined. In many cases, however, the material was of only low value ; it usually contained only about :—

- ½ per cent. of nitrogen.
- 1 " " phosphates.
- 2 " " potash.

On heavy land it has advantages which these figures do not show, as it makes the soil lighter and more workable. These advantages are often more important to allotment holders than to farmers, who tend to lay down heavy land to grass. Farmers who are situated near the dumps, however, would be well advised to secure samples for analysis and then determine whether it would be worth their while to use this material.

Fresh material delivered direct from the city depots is probably somewhat more valuable. A sample recently examined from a London Borough Council contained :—

31·2 per cent. of organic matter ;

0·5 per cent. of phosphoric acid (equivalent to $1\frac{1}{2}$ per cent. of calcium phosphate) ;

0·5 per cent. of potash, and, in addition, nearly 3 per cent. of lime.

As it stands this material is poor, but its phosphate content is to be increased by the inclusion of offal from the fried fish shops and markets. The material is sent out in good condition, and its value to the farmer corresponds with its analysis.

The question is sometimes asked, however, whether it is safe to use such material where potatoes are grown. Any danger that arose would be from spores of disease organisms adhering to the potato peelings which have gone through the ash-pit and so got into the refuse. The danger is only slight, but it exists, and where there is reason to fear the prevalence of wart disease among potatoes it could hardly be overlooked. On grass land or farms where there is no intention of growing potatoes the risk may quite well be taken.

Effect of Fertilisers in Overcoming the bad Effects of Climate.—

Farmers are now thoroughly familiar with the fact that artificial fertilisers increase the growth of crops. There is, however, another aspect of their use which in many instances is highly important.

Chief among the many difficulties arising out of natural conditions with which the farmer has to deal is climate, and particularly rainfall. There is, unfortunately, no known way in which the rainfall can be controlled, nor can the possibilities of rain even be forecasted for more than a short period. Its effects, however, can be mitigated to some extent in two ways :

(1) By using appropriate varieties of crops.

(2) By suitable treatment with artificial manures.

The most effective way of mitigating the effects of heavy rainfall is to give a small dressing of nitrogenous manure at the time of sowing, or as soon as possible after the plant is up, in order to secure an early start, and to accompany this by a relatively large dressing of superphosphate, or, on acid soils, of basic slag. Thus, in a high moorland district where oats are required for cattle, the following might be tried :—

Varieties : Golden Rain, Yelder, Victory.

Manuring : $\frac{1}{2}$ cwt. sulphate of ammonia, 3 or 4 cwt. superphosphate.

The effect of the phosphate is to hasten the ripening processes and thus bring on the harvest some days before it would otherwise be ready. This use of phosphates is well seen in some of the northern counties where cereals liberally treated with superphosphate are ready sometimes as much as ten days in advance of the untreated crops.

In dry conditions, or where the plant tends to ripen off soon, another course must be adopted. Potassic fertilisers should be here used, or failing them, salt. The effect is to continue the growing processes longer than would otherwise happen, with the result that yields are increased. This is probably one of the reasons for the beneficial effect of salt or potassic fertilisers on light sandy or chalky soils : but no doubt other factors are concerned as well.

IN June, 1916, a Committee, known as the Nitrogen Products Committee of the Munitions Inventions Department, was appointed with the sanction of the Minister of Munitions to deal with the matters comprised in the following terms of reference :—

**Final Report of the
Nitrogen Products
Committee.**

To consider the relative advantages for this country and for the Empire of the various methods for the fixation of atmospheric nitrogen, from the point of view both of war and peace purposes ; to ascertain their relative costs, and to advise on proposals relevant thereto, which may be submitted to the Department.

To examine into the supply of the raw materials required, e.g., pure nitrogen and hydrogen, and into the utilisation of the by-products obtained.

Since some of the processes employed depend for their success on the provision of large supplies of cheap power, to ascertain where and how this can best be obtained.

To consider what steps can with advantage be taken to conserve and increase the national resources in nitrogen-bearing compounds and to limit their wastage.

To carry out the experimental work necessary to arrive at definite conclusions as to the practicability and efficiency of such processes as may appear to the Committee to be of value.

As a result of the foregoing steps, to advise as to starting operations on an industrial scale.

The Committee consisted of a number of eminent scientists and representatives of Government Departments, and was under the chairmanship of Colonel Sir Henry E. F. Goold-Adams, K.B.E., C.B., C.M.G., R.A.

It was considered desirable at the end of 1916 that the Committee should submit practical proposals at an early date, and an Interim Report was accordingly issued in February, 1917. A note on the main recommendations of this Report was published in the issue of this *Journal* for February, 1918, page 1254.

The Committee have now issued their Final Report (Cmd. 482, 1920),* a comprehensive document of some 350 pages. They review in some detail the general situation of the nitrogen products industry before and during the War, and express opinions as to the post-war prospects. A large portion of the Report is devoted to the industry in its relation to agriculture, and in view of the increasing use of nitrogen as a fertiliser some of the statements made are deserving of special notice.

Influence of the War.—In their opening remarks the Committee state that the last years of the war situation have been responsible for a fundamental alteration in the status of agriculture in the United Kingdom. The present policy of food production has already had the effect of increasing the home demand for nitrogenous fertilisers to an extent far exceeding the pre-war consumption, and the maintenance of this policy after the War, or its further development, is vitally interconnected with the future of the nitrogen industry. The importance of combined nitrogen in agriculture has long been recognised, but under war conditions a very large proportion of the world's supplies of combined nitrogen had been diverted from agriculture to the production of munitions, thus affording a significant lesson as to the extent to which the security of a nation may depend upon its ability to procure or produce an adequate supply of essential nitrogen products. The continuous increase in the world's demand and the constant upward trend of the price of combined nitrogen, however, have led to the invention and development of processes for fixing atmospheric nitrogen, thus opening up a practically unlimited source of supply. The Committee enumerate and deal in detail with the four principal processes, viz., the by-product ammonia process, the retort process, nitrogen fixation processes, and the ammonia oxidation process.

Post-war Position.—In regard to the post-war demand the Committee express the opinion that the requirements of agriculture are certain to be much larger than formerly, the imperative need for maintaining and extending the world's production of

* Obtainable from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2

food, and the vital importance of combined nitrogen for this purpose, having emerged as one of the salient lessons of the later stages of the War.

They state that the consumption of combined nitrogen practically doubled in the ten years before the War. In evidence given before the Committee it was stated that owing to advances upon the former backward state of scientific knowledge concerning the use of nitrogenous fertilisers, the future consumption could not be expected to continue to increase at the same rate. The Committee are unable to agree with this view for the following reasons: When account is taken of the relative areas under cultivation in the food-producing countries of the world, of the pre-war consumption of nitrogenous fertilisers in the most progressive of the agricultural countries, and of the corresponding consumption in the remaining countries, it is abundantly clear that the quantities of nitrogenous manures employed were in many cases below the most advantageous or profitable level. The difficulties experienced during the War period in obtaining supplies have already provided a salutary lesson as to the importance of fertilisation, and the resulting wider recognition of the value of fertilisers will lead to a large increase in the demand for nitrogenous manures in countries where the consumption has hitherto been very small in proportion to the area under cultivation. In the opinion of the Committee, the provision of a really cheap supply of fixed nitrogen, say, at £40 to £45 per metric ton, or 8s. to 9s. per unit, would lead to a greatly extended consumption of nitrogenous fertilisers.

Estimating the post-war requirements of the United Kingdom the Committee state that, owing to the war policy of food production, the agricultural demand for fixed nitrogen in the form of ammonium sulphate and nitrates has attained at the present time a figure of 60,000 tons per annum, as compared with a pre-war consumption of 25,000 tons, and that there is every prospect of a further increase in the immediate future. From a general consideration of the prospects under a progressive agricultural policy and of a number of other factors bearing on the question, they are of opinion that the future consumption of artificial nitrogenous fertilisers in the United Kingdom might amount to the equivalent of about half a million tons of ammonium sulphate per annum, or 100,000 tons of fixed nitrogen.

The Report concludes with a number of recommendations as a *minimum* provision for safeguarding the future and for

meeting a portion of the growing home demand for various nitrogen products. The recommendations are mainly concerned with the development of the various processes by which nitrogen is obtained, the encouragement of research, and the safeguarding of imperial supplies.

It has recently been decided to remove maximum prices from all oil cakes and meals. Prices are not at present sufficiently stable to make it possible to compile a table of prices for any considerable number of feeding stuffs. The only possible course for guiding purchasers at the present time is to advise them to make use of the annexed table, which gives the feeding value of a number of the more common feeding stuffs classified according to their relative richness in proteins, fats and carbohydrates. Column (1) of the table gives the name of the feeding stuff. In this connection it should be noted that the table does not include all the feeding stuffs on the market. This is best explained by a few examples. The first feeding stuff on the list is ground-nut cake. The cake referred to under this name is a decorticated cake from which the husks of the ground nuts have been removed. Two other kinds of ground nut cake are now on the market, known respectively as undecorticated and semi-decorticated. The latter of these has only come on to the market recently, and the writer is not at present in possession of figures for the composition of this cake. Before next month it is hoped that a number of samples may be collected and analysed so that figures for the composition and feeding value may be added to next month's table. Readers of these Notes will confer a favour on the writer if they will inform him of any common feeding stuffs on the market which are not included in the table, so that samples of these may be collected and examined with a view to their future inclusion.

Column (2) of the table gives the nutritive ratio, that is to say, the relative proportions in which protein or flesh-forming constituents, and carbohydrates and fats or heat-forming constituents, are present in the food.

**Notes on Feeding
Stuffs for March:**

*From the
Animal Nutrition
Institute, Cambridge
University.*

FEEDING VALUE OF COMMON FEEDING STUFFS.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Name of Feeding Stuff.	Nutritive Ratio.	Per cent. digestible.			Digestible Food Units per ton.	Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
		Protein.	Fat.	Carbo- hydrates and Fibre.			
Foods Rich in both Protein and Oil or Fat.							
Ground nut cake ..	1: 0.8	45.2	6.3	21.1	145	78	102
Soya bean cake ..	1: 1.1	34.0	6.5	21.0	122	67	88
Decort. cotton cake ..	1: 1.2	34.0	8.5	20.0	126	71	93
Linseed cake, Indian ..	1: 1.9	27.8	9.3	30.1	123	77	101
Linseed cake, English ..	1: 2.0	26.7	9.3	30.1	120	76	100
Cotton cake, Egyptian ..	1: 2.1	15.5	5.3	20.0	72	40	53
Cotton cake, Bombay ..	1: 2.5	13.1	4.4	21.5	65	38	49
Distillers' grains ..	1: 2.9	18.7	10.2	29.0	101	57	75
Maize gluten feed ..	1: 3.0	20.4	8.8	48.4	122	87	115
Brewers' grains, dried ..	1: 3.5	14.1	6.6	32.7	85	50	66
Coconut cake ..	1: 3.8	16.3	8.2	41.4	103	77	101
Palm kernel cake ..	1: 4.5	14.1	6.1	48.9	96	77	101
Linseed ..	1: 5.9	18.1	34.7	20.1	154	119	157
Bombay cotton seed ..	1: 6.6	11.0	16.8	30.1	100	78	102
Fairly Rich in Protein, Rich in Oil.							
Maize germ meal ..	1: 8.5	9.0	6.2	61.2	99	81	107
Rice meal ..	1: 9.4	6.8	10.2	38.2	79	68	90
Rich in Protein, Poor in Oil.							
Fish meal ..	1: 0.1	54.0	2.0	—	125	56	74
Peas, Calcutta white ..	1: 2.1	23.3	1.1	45.9	97	70	88
Beans, English ..	1: 2.6	19.3	1.2	48.2	100	67	88
Beans, Chinese ..	1: 2.6	19.6	1.7	47.9	101	67	88
Peas, English maple ..	1: 3.1	17.0	1.0	50.0	97	70	92
Palm-nut meal (ex- tracted) ..	1: 3.4	15.6	1.9	48.7	92	66	87
Brewers' grains, wet ..	1: 3.5	3.5	1.5	8.6	21	13	17
Malt culms ..	1: 3.6	11.4	1.1	38.6	70	39	51
Cereals, Rich in Starch, not Rich in Protein or Oil.							
Barley, feeding ..	1: 8.0	8.0	2.1	57.8	83	68	89
Oats, English ..	1: 8.0	7.2	4.0	47.4	75	60	79
Oats, Argentine ..	1: 8.0	7.2	4.0	47.4	75	60	79
Maize, American ..	1: 11.5	6.7	4.5	65.8	94	81	107
Maize, Argentine ..	1: 11.3	6.8	4.5	65.8	94	84	110
Maize meal ..	1: 13.0	5.5	3.5	63.9	86	79	102
Wheat middlings ..	1: 4.8	12.8	4.1	52.5	95	73	96
Wheat sharps ..	1: 5.1	11.6	3.4	51.6	90	62	80
Wheat pollards ..	1: 4.5	13.6	3.7	52.5	97	62	82
Wheat bran ..	1: 4.7	11.3	3.0	45.0	78	50	65
Wheat bran, broad ..	1: 4.7	11.3	3.0	45.4	80	48	63
Locust bean meal ..	1: 22.1	4.0	0.7	69.2	80	71	94

Columns (3), (4) and (5) give the percentages of digestible proteins, fats and carbohydrates respectively.

Column (6), which is calculated from Columns (3), (4) and (5), gives the number of digestible food units in a ton of each feeding stuff.

Columns (7) and (8) give the starch equivalent and the linseed cake equivalent respectively of 100 lb. of the feeding stuff.

The table can be used both as a guide to purchasing, and as an indication of the feeding value of the different feeding stuffs. To use it as a guide to purchasing, the procedure is as follows :

First ascertain the price at which several suitable feeding stuffs can be purchased locally. To these figures add the estimated cost of railway carriage, cartage, grinding or other method of preparation. This will give the cost of the feeding stuffs as fed to the animals. Next look up in the table the number of digestible food units contained in a ton of the feeding stuffs, and divide *the cost per ton of the feeding stuff as fed to the animals* by this figure. A few instances will make this plain. The price of bran at the present time is about £12 10s. per ton at the mill; to this must be added, say, 10s. per ton for carriage and other expenses, so that the cost of bran as fed to the animals would be, say, £13 per ton. Looking up bran in the table, Column (6) states that it contains 78 food units per ton. The price per food unit is therefore £13 divided by 78, or 3s. 4d. per food unit. Dried grains at the present time cost about £14 10s. per ton at the factory or wharf. Again, adding, say 10s. per ton for railway and other expenses, the cost of dried grains as fed to the animals would be £15 per ton. According to Column (6) of the table, dried brewers' grains contain 85 food units per ton. Dividing £15 by 85 the cost per food unit is 3s. 6d. Bran and dried grains are quite similar feeding stuffs suitable to replace each other. At present prices bran is cheaper than dried grains by about 2d. per food unit. Calculated in the same way, palm kernel cake at about £12 10s. per ton at the mill would cost as fed to the animals about 2s. 9d. per food unit, and linseed cake at £25 per ton at the mill about 4s. 3d. per food unit.

As soon as prices have settled down it will be possible to give comparative tables of costs per food unit worked out from the standard prices by this method. In the meantime, while prices are so variable, it is hoped that purchasers may be able to determine the price per food unit for themselves as indicated above.

The table is also useful as an indicator of the relative feeding value of different feeding stuffs. The number of digestible food units per ton is not an exact measure of the feeding value, because it includes an allowance for the manurial value of the feeding stuff. Columns (7) and (8) give a much more reliable estimate of the relative feeding value. Column (7) gives the number of pounds of starch which has the same feeding value as 100 lb. of the feeding stuff; similarly Column (8) gives the number of pounds of linseed cake equivalent in feeding value to 100 lb. of the feeding stuff. Live-stock owners should buy according to the number of digestible food units given in

Column (6), and should be guided in using feeding stuffs by the starch equivalent or linseed cake equivalent as given in Columns (7) and (8).

It may perhaps be useful to give some idea as to the prospect of supplies of feeding stuffs in the future. It appears likely that the supply of millers' offals, which was so short during the War, will be considerably increased in the coming season. The prospects for supplies of feeding barley are, however, not so good, and this feeding stuff is likely to be scarce and dear for some time. There has been during the last few years a considerable change in the importation of barley. Countries which used to send considerable quantities of barley to the United Kingdom have been prevented from doing so by war and post-war conditions. North America has less than the usual quantity of barley to export, and the exchange between the United Kingdom and the States at the present time makes the importation of American barley extremely expensive. The supplies of home-grown oats seem to be fairly satisfactory, but the prospect of importing normal quantities of oats is not good. As regards maize, several countries which used to supply large quantities are no longer able to do so. Last year's maize crop, however, was quite good, both in North and South America, but, as in the case of barley, the exchange makes the importation of maize from these countries extremely expensive. The importation of oil seeds during the last year has increased very largely, resulting in the production of very large quantities of cakes of all kinds. Consumption of cakes, probably on account of the high prices, and possibly, too, because farmers have discovered during the War that they could keep their animals quite satisfactorily on much smaller cake rations than they were accustomed to use before the War, has not increased so rapidly as the production. There is consequently a large stock of cakes in the country at the present time, and it is quite likely that prices will decrease. For some time past cakes have sold considerably under the maximum prices; so much so, that the maximum prices have now been removed, as well as almost all restrictions on their use.

THE present time (5th February) seems a fitting time to review, very briefly, the work accomplished by County Councils and Councils of County Boroughs on behalf of the Ministry of Agriculture and Fisheries, with regard to the work of the settlement of ex-Service men on the land.

**Land Settlement
through Local
Authorities.**

Councils have on their lists 25,905 ex-Service applicants, who have applied for 450,603 acres. Of these applicants 16,017 have so far been approved as suitable for 269,025 acres.

Councils have actually acquired, or agreed to acquire, 162,247 acres, and in addition the councils have 75,000 acres under consideration, the bulk of which, it is hoped, will be acquired at an early date. Of this area 11,620 acres are proposed to be acquired in the exercise of the compulsory powers entrusted to the councils by Parliament.

The London County Council have up to the present not acquired any land for ex-Service men.

Up to date 4,250 men have actually been provided with holdings, on a total area of 59,136 acres. The figures given show that a substantial beginning has been made in the direction of carrying out the promises of the Government with regard to the provision of land for men who have fought for their country.

THE poultry laying trials at the Harper Adams Agricultural College for the 12 months 1918-19 ended on 29th October last, and a Report has recently been issued. This Report sums up the work which is being done for poultry breeders and others who are interested in the improvement of egg production.

**Poultry Laying Trials
at the Harper Adams
Agricultural College,
Newport, Salop.***

The general interest taken in the trials, as evidenced by the increasing number of other trials held since the College commenced this branch of work in 1912, is not confined to the owners of the pens, as the information obtained and fully described in the reports is of considerable value, not only to all who are engaged in improving stock, but also to those who are concerned with egg production. The breeders of utility poultry must remain at a disadvantage compared with the exhibition or "fancy" breeder until a definite standard of points can be agreed upon, and, though steps are being taken to arrive at some agreement in this direction, it is now only

* Contributed by the Harper Adams Agricultural College.

by actual performance at these 12 months' laying trials that the owner of utility birds can prove the quality of his stock.

The results of the College trials for 1918-19 are conclusive in demonstrating the improvement which is taking place in the quality of the utility poultry stock of this country, and it is satisfactory to note that, not only is the standard attained higher, but the general average shows a distinct improvement. Thus, contrasting the results of the first 12 months' trials with those just concluded, the figures are extremely interesting:—

	1912-13.	1918-19.
Best pen (6 birds) ..	1,389 eggs.	1,444 eggs.
Worst pen (6 birds) ..	526 ..	813 ..
Average per pen (100 pens)	911.15 eggs.	1,121.51 eggs.
„ „ bird (600) ..	151.9 ..	186.92 ..

The pens were representative of the leading poultry yards, and also included birds from a number of less well-known people who have not yet established their reputations as breeders of utility stock. The birds competing comprised:—

Light Breeds—

Leghorns.
Campines.
Anconas.
Minorcas.

Heavy Breeds—

Wyandottes.
Rhode Island Reds.
Buff Rocks.
Sussex.
Orpingtons.

The comparison of the breeds is particularly interesting in view of the details obtained as regards the size and weight of the eggs produced, and brings out the fact that a marked improvement is taking place in the hitherto less-favoured breeds such as Rhode Island Reds, Rocks and Sussex, as compared with the more numerous White Leghorn and White Wyandotte breeds:—

	Egg Average, 1918-19.		
	No. per Bird.	Weight per Egg per Bird.	Value of Eggs per Bird.
		oz.	s. d.
Leghorns	189.8	2.04	65 4
Wyandottes	194.14	2.03	68 5½
Rhode Island Reds	194.41	2.09	69 4½
Rocks	173.25	2.06	59 5½
Orpingtons and Sussex	173.05	2.08	61 10½
Other Light Breeds	172.66	2.15	60 3½
Average of all Breeds	186.92	2.06	65 4½

In comparing the quality of the output the total weight of eggs produced by the birds has been ascertained, but for the purpose of valuation the standard of 2 oz. has been taken as the size of grade A egg, and here again the less well-known or favoured breeds show a high standard of output, as will be seen by the following table:—

—	Total Weight.	No. of Eggs Laid.		Percentage Proportion of Grades.		
		oz.	2 oz. and over.	under 2 oz.	2 oz. and over.	under 2 oz.
Leghorns (32 pens) ..	74,470		28,295	8,147	77.64	22.34
Wyandottes (33 pens) ..	78,163		29,579	8,861	76.95	23.05
Rhode Island Reds (8 pens)	19,564		8,172	1,160	87.57	12.43
Rocks (8 pens) ..	17,201		6,255	2,061	75.21	24.79
Orpingtons and Sussex (10 pens)	21,630		8,864	1,519	85.37	14.63
Other Light Breeds (10 pens)	22,302		9,877	483	95.34	4.66
All the Birds (101 pens) ..	233,330		91,042	22,231	80.38	19.62

The number of eggs produced has naturally varied with the season, and it is of interest to compare the number, weight and value of eggs produced during the year. The relationship of these three factors is not very apparent. The figures are given for periods of four weeks commencing with the first period from 3rd to 30th November, 1918:—

—	Period.						
	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.
No. of Eggs ..	3.44	7.11	15.24	15.25	17.93	20.78	20.68
Value ..	1/8½	3/0	6/8½	6/8½	7/4	5/10	5/6½
Weight in oz.	6.4	14.0	31.1	31.2	37.1	43.0	43.8
No. of Eggs ..	8th.	9th.	10th.	11th.	12th.	13th.	
Value ..	17.88	16.78	15.15	14.06	12.47	5.95	
Weight in oz.	4/6½	5/2	5/0½	4/10½	4/5½	2/6½	
	36.4	34.5	31.2	29.24	26.0	12.6	

To poultry keepers the question of cost of feeding is all-important, and the results of the trials, where an accurate record is kept of the amount consumed, as well as the cost, are of great comparative value. The quantity of food consumed per bird in lb. during the year was: Compound meal, 13.7; bran, 4.7; fish meal, 6.1; clover meal, 2.6; pig meal, 0.1; crushed oats, 5.0; wheat, 14.3; oats, 1.9; mixture, 29.0; sharps, 6.6; maize meal, 3.5; palm kernel meal, 1.4.

The cost of feeding has varied slightly month by month and may be stated as under:—

<i>Cost per Bird.</i>				<i>Cost per Bird.</i>			
		s.	d.			s.	d.
1st Period	..	1	3½*	8th Period	..	1	2½
2nd "	..	1	5	9th "	..	1	1
3rd "	..	1	4½	10th "	..	1	3½
4th "	..	1	5	11th "	..	1	4½
5th "	..	1	5½	12th "	..	1	6
6th "	..	1	1	13th "	..	1	5½
7th "	..	1	1½				

During the trials a varied food sheet was possible, though at times it was necessary to use such foodstuffs as were available, as against what was really required. The values as between eggs produced and food consumed seem to have been in an inverse ratio, the cost dropping sharply as the value of eggs increased and *vice versa*. Thus cost of food dropped sharply from £6 11s. 1½d. per 100 birds for the period ending 30th November to £5 12s. 5d. for that ending 19th April, and then rose steadily until £7 12s. 5½d. was recorded for the final period. On the other hand, egg values only reached £8 10s. during the first period, but rose steadily until the March period, when £36 17s. 8½d. was the value of the output per 100 birds. From this highest value the decline was gradual until October, but fell sharply to £12 14s. 2d. for the final month. The weight of food consumed was more constant, and fluctuated between a minimum of 640 lb. and a maximum of 727 lb. per 100 birds per four weeks, the average per period being—cost of food, £6 15s. 11d.; amount consumed, 692 lb.; and value of eggs produced, £24 8s. 6d. per 100 birds. Such figures very clearly bring out the fact that flocks which are showing a low flock average output must be yielding a very low profit, and in many cases are probably being kept at a loss.

The need for egg records is thus obvious. In this connection the question whether a bird can be classed satisfactorily at the end of its first three months' laying as a good or bad layer seems to be decided in the affirmative by the comparison of the best and worst layers in the flocks under trial. It is noted that almost without exception the birds that produced a total of over 200 eggs in the pullet year averaged a 47-egg output during the first three months, whereas the poor layers—of less than 100 in the pullet year—showed an average of only 15·8 during the first three months. Whether or not this test of

* Price carried to nearest farthing. Another ½d. per period should be added to cover cost of grit and vegetables.

output can be regarded as sufficient in itself may seem doubtful, but taken in conjunction with other indications it should certainly be possible to weed out the wasters before any serious loss is incurred on their behalf.

The College trials during the year 1918-19 also included a Single Pen Test—a form of trial not previously known in this country—and the results fully justify the claims which have been made in Australia for this method of comparison of breed and strain. The highest output was that of a White Leghorn pullet, which laid in the 12 months 271 eggs, of which 267 were first grade and the total weight was 588 oz.

The full Report of the College trials has been published, and contains a summary of the results of other competitions which have been held in this and other countries.

THE increased employment of women in agriculture during the War has involved the consideration of a number of questions relative to their continued employment in the different branches of the industry when more normal conditions of rural labour were restored. It was felt that numbers of women who had been working on the land during the War would wish to remain in agricultural occupations and to avail themselves of openings which might be offered, either on farms or in industries allied to agriculture. A Committee composed mainly of representatives of the Ministry of Agriculture was appointed under the chairmanship of Mrs. Roland Wilkins in November, 1917, to consider what economic part women can take in agriculture, and to recommend what steps should be taken to give practical effect to such conclusions as might be drawn.

The Report of the Committee has recently been issued.* It sets out in some detail the prospects open to women in arable farming, stock farming and dairying, small holdings, market gardening, flax growing and various rural industries. A chapter on the history of the employment of women in agriculture should be of special interest to the agricultural student. After touching on a number of other subjects bearing on the problem of the employment of women in agri-

* Report of Sub-Committee appointed to consider the Employment of Women in Agriculture in England and Wales. Obtainable from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, price 1s. 6d. net.

culture, such as voluntary associations and women's institutes, the Report concludes with a summary of the Committee's conclusions and recommendations.

The conclusions of the Committee can be briefly summarised as follows :—

The Supply of Women Workers.

- (1) There is a large unsatisfied demand for the domestic farm servant in certain areas; this type of worker appears to be an essential factor in the economy of small hill farms of the stock-raising and dairy type.
- (2) There is a very slightly increased demand over pre-war times for full-time milkers and stock women, dairy-maids who milk, and poultry workers.
- (3) It is likely that the demand for part-time milkers will increase substantially.
- (4) An increase in the women dependents of small holders will naturally follow that of the men established under the Government scheme, and these women being an important factor in the success of the small holding, every consideration should be given to all local possibilities of their education, organisation, and social life.
- (5) A demand for certain types of workers is conditional on the extension of certain branches of farming which may be encouraged by Government policy; some again, such as the casual field workers on arable farms, depend on the general condition of other trades.
- (6) The present supply of local seasonal workers in market gardens and in afforestation is likely to prove adequate: the increased demand due to any extension in the areas devoted to these branches of cultivation during the next few years balancing the reversion of the substitution of women for men which took place during the War.

In the case of teachers of dairying similar conditions are anticipated.

The Retention of Local Women in Rural Areas.

- (7) The establishment of certain industries such as fruit-canning, jam-making, fruit-bottling and milk-drying in rural areas has caused a small demand for workers drawn from the locality. Should these undertakings spread the number of workers required would be correspondingly greater. The Committee have pointed out that this would act advantageously in retaining women in rural areas, owing to the variety of interest offered in employment. The retention of these local women

is an important factor in the development of rural areas.

- (8) Further, bacon factories and those dealing with fruit, while only offering in themselves a small demand for women's work, indirectly influence the permanent settlement of women in the district by encouraging the development of small holdings in the immediate area for the supply of their raw materials.

Actions required.—The specific recommendations of the Committee are :—

- (1) That fuller immediate action be taken along the lines recommended by the Report of the Education Conference on the Agricultural Education of Women with regard to local instruction by County Authorities.* These recommendations are :—
 - a. Itinerant instruction should take the form of organised classes rather than that of lectures, and every part of a county should be covered in a definite cycle of years.
 - b. Farm schools, or fixed courses of instruction taking their place, should be increased, so as to provide one for every county or two counties.
 - c. Domestic economy should form part of the curriculum in every organised course.
 - d. Provision of scholarships—
 - (a) from itinerant classes to farm schools.
 - (b) from farm schools to collegiate institutions.
- (2) That the curriculum of Farm Institutes should provide special domestic economy classes dealing mainly with labour-saving methods and the use and preservation of home-grown produce ; and that, in those areas where the system of domestic farm servants exists, the Farm Institutes should organise local demonstration classes and simple trials on the above subjects.
- (3) That a number of scholarships for the best of the farm servants themselves should be established at the Farm Institutes for the counties in which farm servants are numerous.
- (4) That all measures for the simplification and acceleration of methods of working in the home and byres should be considered by those responsible for agricultural education and manual training in the local areas.

* See this *Journal*, December, 1915, p. 859.

- (5) That Women's Institutes should develop as fully as possible the experiments they have begun in organising demonstrations in labour-saving methods and in the various branches of household economy ; and that local Education Authorities should give them every facility for classes in connection with these subjects.
- (6) That Women's Institutes should endeavour to extend their organisation as widely as possible amongst wives of farmers and small holders and amongst farm servants.
- (7) That the attention of farmers and landowners be directed to the desirability of improvements in byres, yards and homes with a view to curtailing unnecessary labour.
- (8) That in dairying districts Local Education Authorities should organise milking classes.

That Local Agricultural Associations should consider the advisability of offering prizes for women milkers at local shows.
- (9) That short courses should be provided for training women as stock-women at Farm Institutes as long as the demand for their services exist ; and that scholarships or financial assistance should be given in connection with the short courses.
- (10) Scholarships or assisted Studentships for training for skilled posts in dairying and cheese factories should be provided so as to place these posts within the reach of the small farmer's daughter and the farm servant.
- (11) That the recommendations of the Agricultural Education Conference as regards poultry be acted on. (These recommendations are (a) the formation at one of the existing Agricultural Colleges of a training course for poultry keepers, (b) the institution of a national examination in poultry in connection with the above.)
- (12) That the present system of itinerant instruction in poultry keeping be extended and supplemented by the establishment of demonstration centres.
- (13) That the system of supplying stock poultry and eggs through approved stations be extended.
- (14) That demonstration centres should be established in market-gardening districts in which small holders are numerous ; and that instruction in all kinds of skilled work in connection with fruit be provided for women.
- (15) That the duty of obtaining accurate statistics relating to women engaged in agriculture, and of maintaining

adequate information upon any changes in the number of women so engaged, be urged upon the appropriate authority.

A detailed statement of the Committee's conclusions and recommendations, taking each type of industry separately, is given in tabulated form.

THE question of the future cropping of the land recently broken out of grass is seriously exercising the minds of many farmers. There are at least four different ways in which such land can be treated, viz. :—

**Farming of Land
Broken up during
the War.**

1. The land may be worked in with the rotational system hitherto in force.

2. A proportion of the root shift may be devoted to silage crops.

3. Temporary leys of several years' duration may be introduced into the rotation.

4. The land may be sown down to permanent grass.

1.—With the introduction of the Norfolk or 4-course rotation, in which roots occupied 25 per cent. of the arable land, it was possible to keep the land clean, and, by feeding cattle and sheep, to maintain a reasonable level of fertility without recourse to artificial manures. As such manures, however, came more and more into use, a smaller area of roots sufficed to maintain the land in good condition, and roots came to occupy 20 per cent. or less of the arable land. (In the case of heavy land the proportion may be as low as 5 per cent.) Even before the War, roots were commonly regarded as an expensive crop. Under present conditions they are still more so. It seems clear, therefore, that the extra arable area arising out of war conditions will not generally be maintained on a short rotational system, in which roots requiring singling, lifting and storing would take the same prominent place as of old. If the rotation hitherto practised is adopted, crops such as rape and kale will probably, in part, replace the ordinary root crops.

2.—In recent years farmers have begun to look to ensilage as a means of reducing the root shift, particularly under conditions where roots are a specially risky crop. An autumn-sown silage crop is largely independent of weather, does not need a fine tilth, keeps down weeds, and is ready for removal in July, thus affording opportunities for a half fallow, or, if required, a second green crop.

In the absence of a silo, a mixed crop of oats and vetches, or oats and peas, may be made into hay or ripened, and so reduce the root shift and the winter bill for feeding stuffs. (In suitable circumstances lucerne might be tried.)

3.—A third possibility is the lengthening of the rotation by the introduction of temporary leys. If these were of three years' duration, then in a rotation of seven years there might be three shifts in corn, or 43 per cent. as compared with 50 per cent. in a 4-course rotation. The production of about an extra quarter per acre, which might reasonably be expected in the case of the longer rotation, would bring the yield of corn per 100 acres arable up to that of the shorter rotation. Thus, from the standpoint of corn production, the country would not lose by the change; indeed, it might well gain considerably. The root and clover crops would probably be healthier.

There remains the doubt that will arise in many minds as to whether temporary leys can be successfully established under all conditions. In Scotland, in Wales, and generally in districts with considerable rainfall, the practice is already common. Trials have been made in other districts, but further experiments on this point in such districts are necessary. In experiments carried out in the Eastern Counties under the auspices of Cambridge University it would appear that such leys can be successfully laid down, particularly if the seed mixture adopted is on the lines of the Clifton Park system, that is to say, if it consists of a variety of pasture plants including those of a deep rooting and drought-resisting character.

Many of the heavier and of the lighter lands, too, are to-day suffering from lack of organic matter. The former are consequently difficult to work and both are apt to dry out. The ploughing-under of a three-years'-old turf would go far to mitigate this state of affairs.

4.—The last resort is a return to permanent grass. In the case of difficult, inaccessible, or inadequately drained land, or land adjoining the homestead, which has recently been ploughed out, a return to permanent grass may be justified, but care should be taken to choose a suitable seed mixture. The present cost and scarcity of seed makes such care all the more necessary. Farmers with no experience to guide them should consult the Agricultural Organiser of their county, with a view to being supplied with all available data on the subject.

OFFICIAL NOTICES AND CIRCULARS.

N.B.—The Orders mentioned in this section of the JOURNAL may usually be obtained at the price of 1d. each from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, and 28, Abingdon Street, London, S.W. 1; 37, Peter Street, Manchester, and 1, St. Andrew's Crescent, Cardiff.

THE following Circular Letter (No. C.L. 276/C.1) was addressed to County Councils in England and Wales, except the London County Council, by the Ministry on 15th January :—

**Ministry
of Agriculture and
Fisheries Act,
1919.**

SIR,—I am directed by the Minister of Agriculture and Fisheries to invite the attention of your Council to the provisions of the Ministry of Agriculture and Fisheries Act, 1919,* which received the Royal Assent on

23rd December, 1919.

This Act is not concerned in any way with agricultural policy, but is simply a measure for rendering more efficient the existing machinery for dealing with agricultural matters. It marks an epoch in the history of County administration, for it enables the numerous powers and duties of the County Council, in regard to agriculture, to be brought within the range of a single Committee. Furthermore, it brings formally within the County organisation the work now done by the Agricultural Executive Committees.

It cannot be emphasised too clearly that the Act is not designed to supersede any Committee of the County Council now dealing with a particular branch of administration. On the contrary, it is the intention of the Act that so far as possible the existing Committees should be linked together and fitted into a general scheme, which will give to agriculture in the work of the County Councils a position appropriate to its importance. Certain changes may be needed in order to obtain a workable scheme, but, broadly speaking, no efficient machinery need be scrapped, and no existing Committee of the County Council dealing with agriculture need be placed in a position of less authority in consequence of the passing of the Act.

The Minister would like to take this opportunity of expressing his high appreciation of the admirable and efficient work done by those who undertake, often at the cost of much personal sacrifice, the ever increasing burden imposed on Local Authorities in connection with the local administration of matters affecting the agricultural industry. Lord Lee feels confident that under the new legislation the authority of County Councils in dealing with agricultural matters will be strengthened and that the cordial relationship which has always existed between Councils and the Ministry will be maintained.

The Act makes provision for setting up Councils of Agriculture and an Agricultural Advisory Committee for England and Wales, and also an Agricultural Committee for each Administrative County and County Borough. This Circular deals only with the County Committees provided for in Part III. of the Act, and its object is to set forth as concisely as possible the main provisions of that Part of the Act and to indicate their effect on county administration.

* See also this *Journal*, January, 1920, p. 962.

Every County Council (except the London County Council) is required to establish an Agricultural Committee to be appointed in part by the County Council and in part by the Minister. The County Council is to nominate not less than two-thirds of the members, and persons so nominated need not be members of the Council if the Council so determine. Each Council must make a scheme establishing an Agricultural Committee to be approved by the Minister before 23rd June, 1920, and if by that date a scheme has not been approved, the Minister may make a scheme after consultation with the Council.

Powers of the new Committees.—To the Agricultural Committee and its Sub-Committees in each county will stand referred all matters relating to the exercise of the Council's powers under :—

- (1) The Destructive Insects and Pests Acts, 1877 and 1907.
- (2) The Diseases of Animals Acts, 1894 to 1914.
- (3) The Fertilisers and Feeding Stuffs Act, 1906.
- (4) The Land Drainage Act, 1918.
- (5) The Small Holdings and Allotments Acts, 1908 to 1919; and also all other matters relating to agriculture except (a) such matters as under the Education Act, 1902, stand referred to the Education Committee, and (b) the raising of a rate or borrowing.

With regard to education, provision is made for arranging that matters relating to agricultural education, which otherwise would stand referred to the Education Committee, may be referred to the Agricultural Committee.

A County Council may delegate to the Agricultural Committee any of their powers in relation to the matters specified above. It will, however, obviously be impossible for an Agricultural Committee itself to deal with the whole of the matters brought within its range, and the Act therefore provides for the appointment of Sub-Committees and for delegation to those Sub-Committees of any of the powers of the Agricultural Committee. The scheme should provide the necessary authority for such delegation of powers to Sub-Committees.

The Act authorises payment as part of the expenses of the Agricultural Committee of travelling expenses and subsistence allowance of members of that Committee or of any of its Sub-Committees if the scheme so provides.

It is obligatory for the Agricultural Committee to appoint :—

- (1) A Small Holdings and Allotments Sub-Committee.
- (2) A Diseases of Animals Sub-Committee.

These Sub-Committees will act as the Statutory Committees under the Small Holdings and Allotments Acts, 1908-1919, and the Diseases of Animals Act, 1894, respectively. The Small Holdings and Allotments Sub-Committee will, until 31st March, 1926, have full executive powers (except the power to raise a rate or loan) without special delegation of powers by the County Council or the Agricultural Committee. The Act provides that this Sub-Committee shall comprise one or more members to represent tenants of small holdings and allotments.

The Minister may authorise the Agricultural Committee or a Sub-Committee to exercise on his behalf any of his powers under Part IV. of the Corn Production Act, 1917, or Part II. of the Land Drainage Act, 1918.*

* See article on Land Drainage in this issue, p. 1088.

It will be seen from these provisions that the County Council may so constitute their Agricultural Committee that the Small Holdings and Allotments Committee and the Agricultural Executive Committee shall become, without substantial alteration, component parts of the new committee, and carry on without interruption the work of which their members have acquired an intimate knowledge.

Attention is, however, called to Sub-section (4) (a) of Section 7 of the Act, which requires that a scheme shall provide for the appointment by the Minister of not more than one-third of the members of the Agricultural Committee or of any Sub-Committee to which the powers of that Committee are delegated. The Minister will expect to appoint the full quota of members of the Small Holdings and Allotments Sub-Committee, the Agricultural Executive Committee and any other Sub-Committee whose operations entail actual or contingent liabilities for expenditure from State funds.

A further Circular will be issued shortly containing suggestions as to the lines on which a scheme for constituting an Agricultural Committee should be prepared and enclosing a Model Scheme. In the meantime any County Council is at liberty to formulate its scheme, and it may, therefore, be useful to remind the Council that schemes must provide for the appointment of such persons only as have practical, commercial, technical or scientific knowledge of agriculture, or an interest in agricultural land, and for the inclusion of women as well as men.

I am to add that the further circular referred to above will deal not only with matters of organisation but also with the question of finance and accounts.

I am, etc.,
(Signed) LAWRENCE WEAVER,
Director-General of Land Settlement.

THE following information was contained in a Memorandum recently issued to County Horticultural Sub-Committees by the Ministry:—

Introduction.—The important part played

Potato Trials. by the potato crop makes it desirable that growers should be able to obtain adequate and reliable information on all matters relating to potato culture, the many phases of which may best be brought to the growers' notice through demonstration plots instituted for the purpose of finding out those varieties best suited to the different districts and of demonstrating the approved methods of potato culture.

Wart Disease Note.—The Ministry require the planting of immune varieties in those areas in which Wart Disease is known to be common and widespread, and in such areas committees should use immune varieties only for their trials; whilst those committees in the clean districts should demonstrate the value of these immune varieties and test their comparative merits with well-known susceptible kinds.

Supply of Seed.—The source of the seed potato influences the resulting crop to such an extent that all the seed should be obtained from the same source. It is advisable, therefore, that the seed should be purchased in bulk by the Ministry and distributed to the various committees. The seed potatoes will be invoiced at cost price to the committees.

Quantity of Seed.—In carrying out these trials 14 lb. of each variety should be planted on land which has been prepared according to the instructions given below.

Preparation of Land.—The land used in all allotment trials should be bastard trenched.

Manures.—The land should receive farmyard manure at the rate of 10-15 tons per acre, and, preferably, to be applied in the drills at the time of planting.

Artificial Manures.—These should be applied as follows:—

Superphosphate,* 26 per cent. 4 cwt. per acre.

Sulphate of Ammonia 1 " "

 " Potash,* 49 per cent. .. 1 " "

In making these suggestions regarding manuring, it must be borne in mind it may be necessary to modify them in accordance with the local customs and conditions.

Varieties.—In 1920 it is proposed that the trials should be divided into two main sections:—

Part 1.—Demonstration of the cropping powers of the well-known immune kinds, such as:—

1st *Earlies.*—Snowdrop, Dargill Early.

2nd *Earlies.*—Great Scott, Arran Comrade.

Main Crops.—Majestic, Kerr's Pink, Golden Wonder, Tinwald Perfection, Abundance.

Part 2.—Early Varieties.—During 1920 it is considered important to institute trials to test the earliness of cropping qualities of certain early varieties. It must be realised that certain varieties are grown and marketed as earlies, which are not really earlies, if regarded from the point of view of maturity. "Epicure" is a good example of this. It is a variety which "bulks" early, and can be marketed early, yet if judged by its date of maturity, it is a second early. The same remark applies to "Eclipse" or "Sir John Llewellyn."

It has been maintained that "King George" is a variety which, if treated as an early, will be ready for lifting quite as soon as "Epicure." Last season, in many districts "Arran Comrade" matured earlier than "Epicure." It is, therefore, of the greatest importance that this year this problem of earliness should be tested in a thorough manner in all those districts where early potatoes are grown.

Note.—The trials of early varieties are for the express purpose of comparing the earliness of some particular varieties. To obtain reliable results it is obvious that the seed of the many kinds must all come from the same source, be treated in a similar way, planted on the same date, and the crop given equal opportunities for development. The important point is not merely the determination of a date when the crop matures, but of a period when the crop may be profitably marketed. This is a point that should be well considered.

The instructions regarding supply of seed, manuring, etc., are the same as for the cropping trials, but the varieties may be different, as below:—

Varieties for 1920.—Three of the leading well-known first earlies should be grown as controls with which the new varieties may be compared. The three varieties which should be used for this purpose are "Duke of York," "Ninetyfold," and "Epicure."

* If other grades are used, such quantity should be applied as will provide the same amounts of phosphate or potash as those indicated.

To summarise, the varieties to be included in this year's trials are :—

Duke of York	} For clean lands only.
Ninetyfold.	
Epicure.	
Dargill Early.	
Arran Rose.	
King George.	
Nithsdale.	
Arran Comrade.	
Snowdrop.	

Planting.—The time of planting will vary slightly according to the district. The trial plots should be planted at what is considered a suitable time for planting potatoes in the district. It is further suggested that a distance of 26 in. between the drills and 12 in. between the sets should be adopted throughout all the trials. Any departure from these distances should be noted in the reports of the trials.

Reports.—The committees will, of course, prepare full reports for the instruction of farmers and allotment holders in their own districts. The Ministry will, however, also require a brief report drawn up on certain definite lines in order that they may issue a summarised report of all the trials in the country.

In previous years trials of potatoes were carried out for the Ministry by a few people in various parts of England, and, where satisfactory, committees should continue the trials at the old centres and institute fresh trials in other districts.

In dealing with Wart Disease of potatoes it is essential that only true stocks of immune varieties of potatoes should be planted in infected areas. To assist growers in these areas in

**List of Growers of
Immune Varieties of
Potatoes in
England and Wales.**

obtaining suitable stocks for planting this season the Ministry last year arranged for their Inspectors to examine growing crops of immune varieties and to certify those which were true to type and reasonably free from "rogues." A list of the growers whose crops were inspected and certified has been prepared and is now published as Miscellaneous Publication No. 26. Copies of this publication may be obtained from the Ministry, 3, St. James's Square, London, S.W.1, price 6d., post free.

In accordance with the decontrol of British- and Irish-made cheese, already announced (see Note in last month's issue, p. 1041), the Food Controller has issued an Order (No. 98) revoking as on 1st February, 1920, the following Orders :—

**Decontrol of Home
Cheese.**

1. The British Cheese Order, 1917.
2. British Cheese (Requisition) Order, 1918.
3. Cheese (Export from Ireland) Order, 1918.
4. Caerphilly Cheese (Retail Prices) Order, 1919.

As already announced, the Ministry of Food will purchase the suitable varieties of whole-milk hard cheese manufactured in Great Britain and Ireland up to and including 31st January, 1920, and

delivered or advised to the Government Factors up to and including 29th February, 1920. Such cheese not advised or delivered to the Government Factors on or before 29th February, 1920, will not be accepted as Government purchase. The cheese accumulated in the Government Pool will be distributed during the months of January February and March, 1920, under Government Control.

At the Lambeth County Court his Honour Judge Parry gave his reserved judgment in the case of *Deering v. Watney*, in which John Deering, of Plaxtol, claimed at the Sevenoaks

**Legal Decisions under
the Corn
Production Act.**

County Court, from Colonel Charles F. Watney, of Ivy Hatch Court, £24 3s., being the difference between wages received by him as gardener and the minimum wage allowed by the Agricultural Wages Board (under the Corn Production Act) for odd time that he alleged he was engaged in agriculture.

"The defendant," said his Honour, "has about 20 acres of land attached to his house, about five or six lawns and gardens, of which an acre and a half is kitchen garden. There are five acres of plantation, five acres of grazing and five acres of cherry and apple orchard. The defendant does not carry on the business of agriculture. He has sold surplus fruit, but this year there was no surplus fruit. The applicant was employed to work in the gardens, especially the kitchen garden, and to do odd labouring jobs when not wanted in the garden. There is no doubt that he did work in the plantation pruning the nut bushes. The evidence is conflicting as to how long he worked there. The defendant was at the War, and his wife left matters to the bailiff. No objection was taken or claim made at the time, and no record of hours kept by either party. He also cut some bracken for bedding. I find, as a fact, that he was employed on these jobs for four weeks in all and not more, and during the rest of his time he was employed on his main and proper work in the kitchen gardens.

"The applicant contends that he is entitled to the minimum wage during the whole of his employment. Clause 4 of the Act says that 'Any person who employs a person in agriculture,' shall pay the minimum wage rate. Clause 17 says that agriculture includes the use of land as orchard or woodland or market garden. I think the main work of the applicant was in the kitchen gardens, and I hold that the applicant cannot claim the minimum wage when so employed. I think for about four weeks he was employed in agriculture within the meaning of the Act. I see nothing in the Act to prevent a man employed in another capacity claiming a minimum wage, during such time as he is actually employed in agriculture. He put in a claim for a fortnight's haymaking. He could not swing a scythe, but he helped to pitch the hay. Everyone in the house, from the visitors downward, did the same. It is an almost universal practice in English country life for all the household, including domestic servants and visitors, to help in the hay-field during the hay harvest.

"I do not think, if a man's butler helped to pitch hay, he would be a workman employed in agriculture within the Act, and I have not allowed the applicant anything on this part of his claim. In my view the mere fact, in an estate of this kind, that a man does an odd job of an agricultural character does not entitle him to the minimum wage,

but when he is taken away from his usual work and put for a substantial time in real agricultural work he is entitled to the minimum wage. The actual orders of the Wages Board were not produced, but the applicant is entitled to the difference between the minimum wage and the actual wage paid to him for four weeks. If this is not agreed, I remit to the Registrar to assess the amount." (*Wages Board Gazette*, 15th January, 1920.)

**Profiteering on Hay
and Straw.**

AN Order applying the Profiteering Act to hay and straw has been made by the Board of Trade. The text of this Order was published in the issue of the *London Gazette* for 6th January.

THE Food Controller has issued an Order revoking, as from 1st February, 1920, the Oils, Oil Cakes and Meals (Requisition) Order, 1917. Previous references to this Order were published in the issues of this *Journal* for December, 1917, p. 1046, and May, 1919, p. 211.

**Revocation of Oils, Oil
Cakes and Meals Order,
1917.**

IT was announced by the Food Controller on the 31st January, that the administration of the regulations affecting the control of hides hitherto exercised by the Ministry of Munitions will be vested in the Ministry of Food for the remainder of the period of meat control.

ACCORDING to the issue of the *Seed World* (United States) for 19th December last, it would appear from information furnished by the Agricultural Adviser to the Danish Government that Denmark must now be regarded as a serious competitor in the world market for certain kinds of seed, the supply of which before the War was practically the monopoly of English growers. In 1916 the acreage under turnips for seed in Denmark was less than 3,500 acres; last year it had increased to 16,677 acres. Swede seed showed an increase from 2,372 to 7,790 acres, and mangold from 3,410 to 5,310 acres in the same period. The remarkable extension of seed growing in Denmark has been caused by the rapid rise in seed prices during the War. Many Danish farmers took up the growing of seeds, who, lacking the knowledge and experience of old growers and frequently unable to obtain satisfactory stock seed for planting, could not maintain the high quality which has characterised Danish-grown seeds in the past; nevertheless, the increased production must affect the hold that the English growers have had on the world market for such seeds.

Attention is also being given to the growing of root seeds in the United States of America. Before the War the production was negligible, but last year the States produced 123,000 lb. of swede and 456,000 lb. of turnip seed.

THE amount provided for in the Budget of the United States Department of Agriculture for the year 1919-1920 is £7,060,000, or and increase of £1,250,000 over the amount Budget of the United States Department of Agriculture for 1918-1919. The following are the amounts* allotted to the principal Bureaus in the two years.

	1919-1920.		1918-1919.
	£		£
Office of Secretary ..	167,000	..	160,000
Weather Bureau ..	392,000	..	399,000
Animal Industry Bureau ..	1,205,000	..	850,000
Plant Industry Bureau ..	704,000	..	653,000
Forest Service ..	1,244,000	..	1,195,000
Chemistry Bureau ..	290,000	..	259,000
Soils Bureau ..	102,000	..	102,000
Entomology Bureau ..	286,000	..	206,000
Biological Survey ..	155,000	..	123,000
Division of Publications...	50,000	..	45,000
Crop Estimates Bureau ...	77,000	..	72,000
State Relation Service...	1,023,000	..	657,000
Public Roads Bureau ..	124,000	..	124,000
Markets Bureau ..	586,000	..	422,000

The largest increases during the year are shown by the Bureau of Animal Industry (£355,000), the Bureau of Plant Industry (£51,000), the Forest Service (£49,000), the Bureau of Entomology (£80,000), the States Relation Service (£366,000), and the Bureau of Markets (£164,000). The States Relation Service consists of federal contributions to the experiment stations, demonstrations and extension work of the States.

A NEW stallion farm, the only one of its kind in the country, was established by the United States Department of Agriculture in co-operation with the Wyoming Agricultural College, at Buffalo, Wyo., early in July. It is to be known as the United States-Wyoming Horse-breeding Station, where the work that has been done for the past 15 years by the

Department in co-operation with the Colorado Agricultural College will be continued. The object of the work at this station will be to produce high-class stallions suitable for the production of utility horses adapted to western range and farm conditions. Stallions at this station are available for use by mare owners in the community, and from time to time they will be sent for service to different parts of Wyoming and Colorado. Stallions developed for the range weigh from 1,200 to 1,400 pounds. A standard-bred stallion, Harvest Aid, has recently been purchased. He is by the champion trotting stallion, The Harvester, and his dam is Santos Maid, a mare which holds the trotting record of 2:08½, and a daughter of Peter the Great, the leading sire of speed in America. It is not the purpose at the horse-breeding station to develop speed animals, but it is well understood that a good stallion from a family noted for its speed is highly desirable for the production of active utility horses. — (*The Breeder's Gazette*, 25th September, 1919).

The amounts are "par values."

A NOTE published in the issue of the *Journal Officiel* for the 14th October, 1919, gives particulars of an Act passed by the French Government respecting the formation in France of different kinds of agricultural benefit societies, with a view to assisting the population in districts devastated by the War. The conditions of formation of these Societies are to be decided by the Ministries of Agriculture and Food, and Finance. The Societies may receive State loans through local banks. All people connected with agricultural development, in any way, may form themselves into credit societies. Rural artisans, who do not employ more than two men continuously, such as shoeing-smiths, smiths, implement repairers, harness-makers, shoemakers, and charcoal burners, also come within the provisions of this Act.

**Agricultural Credit
Facilities for
Devastated Regions
in France.**

DECISIONS have recently been given by the High Court on two points of importance in connection with the administration of Part II. of the Corn Production Act. One case was heard on the 21st and the other on the 22nd January before the Lord Chief Justice and Justices Avory and Sankey.

**Legal Decisions
affecting
Minimum Wages.**

In the first case the Agricultural Wages Board appealed against a decision of the Knaresborough Bench. The Board had proceeded against an employer for the non-payment of the minimum to a horseman who was engaged on a contract of service for one year, which was still running, at a wage of £20 per annum, in addition to board and lodging. The Court have decided that while the contract is void as regards the amount mentioned therein, it was still a contract for service for a year, and that the liability to pay the worker not less than the minimum wages did not arise—and in fact that no legal liability to make any payment arose—until the end of the term. If then the employer failed to pay a sum which for the whole term of service amounted to less than the minimum rates fixed, he would commit an offence, but until that time no offence could, in fact, be proved. The effect of this judgment appears to be far-reaching, as it seems to imply that any man engaged for a year is dependent on the good-will of his employer for any payments during his year of service.

In the case heard on the 22nd January, the Agricultural Wages Board appealed against a decision of the Warwick Bench, the point at issue being whether a private garden from which a certain amount of produce is sold comes within the definition of a market garden under the Corn Production Act. The judgment lays down that a market garden is a holding cultivated wholly or mainly for the purpose of the trade or business of market gardening. The decision of the High Court clears up a question about which there has been much discussion, and the appeal was taken by the Wages Board so that uncertainty might be removed for the future.

Both decisions were given in full in the issue of the *Wages Board Gazette* for 2nd February.

SINCE the last issue of the *Journal* (p. 1044), outbreaks of Foot-and-Mouth Disease have been confirmed in six fresh centres, and the position in the districts concerned is as follows :—

Foot-and-Mouth Disease.

Wiltshire.—The initial outbreak was confirmed at Grittenham, Brinkworth, on the 15th January, since which date six further outbreaks have occurred, the latest being on the 11th February. The usual Order prohibiting movement over a wide area was issued on the 15th January, and on the 29th January the Scheduled District was extended on the eastern side owing to the spread of disease in that direction. Restrictions have now been modified except as regards the Prohibited Area around the scenes of the outbreaks.

Bedford, Northumberland and Flint.—Isolated outbreaks were confirmed at Willington (Beds.), Amble, Acklington (Northumberland), and Rhuddlan (Flints.) on the 24th January, 21st January, and 31st January respectively. No further developments occurred, and in all cases restrictions have been modified in respect of considerable portions of the Scheduled Districts.

Lancashire.—Two outbreaks of disease were confirmed in Lancashire on premises near Newton in Cartmel, the first being on 24th January and the second on the following day. Since the latter date there has been no extension of disease, and the restrictions have been modified except in a small area surrounding the Infected Places.

Devonshire.—An outbreak of Foot-and-Mouth Disease occurred at Dean Prior near Buckfastleigh on the 28th January, and the usual Order prohibiting movement was issued accordingly. On the 5th February an outbreak occurred near Bow, some six miles outside the Scheduled District, and the Scheduled District had to be extended northwards for about 15 miles. A further outbreak occurred on the adjoining farm on the 7th February. The restrictions imposed have since been modified in the outer portions of the original Scheduled District.

All restrictions on movement of animals imposed in connection with the outbreaks in Durham, West Sussex, Yorkshire (West Riding), Hampshire, Dorset and Essex have been withdrawn and modifications of the restrictions have been made in the East Kent district.

SINCE the note which appeared in the last issue of the *Journal* was written, a further case of Rabies has been confirmed (on 13th January) at Addlestone, Surrey, in the Inner or dangerous

Rabies.

Zone of the London, Middlesex, and District Muzzling Area. The inquiries which were made by the Inspectors of the Ministry show that the infected dog was apparently bitten by what is known as the "Ealing dog," that is, the animal which ran between Ealing and Weybridge in April last. It is fortunate that this case occurred well within the dangerous Zone, which was specially scheduled to catch up any cases of this kind. The result of this outbreak is that it has not been possible entirely to revoke the Muzzling Orders affecting the London, Middlesex, and District

Area, as had been hoped, by the end of January. The Ministry, however, have felt justified in contracting the existing Area so as to exclude from the Muzzling Order the whole of the County of London, the whole of Middlesex (except the portion lying to the south-west of a line from Uxbridge to Twickenham), that part of Hertfordshire which was previously subject to the Order, a small part of Buckinghamshire, and the south-eastern half of Surrey. An Order to this effect came into operation on the 2nd February.

This Order does not withdraw the restrictions on the movement of dogs out of the contracted Muzzling Area, nor the restrictions on the movement of dogs out of the Inner or Dangerous Zone. This last includes the western portion of Surrey and small parts of Berkshire and Hampshire.

The outbreak at Addlestone on the 13th January has rendered the maintenance of restrictions in this dangerous Area, for a further period, essential.

THE Food Controller issued an Order dated the 24th January, 1920, which revoked as on the 1st February, the Use of Milk (Licensing) Order, 1918. A note on the provisions of this Order was published in the issue of this *Journal* for June, 1918, p. 354.

**Revocation of
the Milk (Licensing)
Order, 1918.**

IN 1916, as a war measure, with a view to increasing food production by a rapid improvement of our poultry stock, the Ministry of Agriculture made arrangements for the distribution of sittings of eggs, day-old chicks, and adult stock birds, to small holders and cottagers. The scheme has been worked through Egg Stations, which sent out sittings from January to May; day-old Chick Stations, distributing chicks between February and June; and Incubating Stations, from which eggs, chickens, and stock birds could be obtained. The egg and chick stations are selected annually for seasonal work; the incubating stations are more permanently established for work throughout the year.

The scheme has accomplished valuable work, and it is now arranged that Local Authorities shall take it over as part of their ordinary activities. Two-thirds of the cost will be borne by the Ministry of Agriculture. One hundred and forty-four Egg Stations and 19 Chick Stations have been approved in 26 counties to date; returns from the remaining counties have not yet been received. Distribution from the Incubating Stations in Anglesey, Cornwall, Cheshire and Denbigh is to continue. Four hundred and twenty-seven thousand three hundred and seventy-four eggs and 16,233 chickens have been distributed from the Egg and Chick Stations since 1916 at reduced rates. This year the subsidy to station holders will be 2s. per dozen for sittings of eggs, and up to 5s. per dozen for chickens. The price charged to

applicants for sittings and chicks is fixed by the County Authority for the area in which the Station is situated, to whom application should be made for particulars regarding the scheme.

January Journal: Errata. ON p. 963, lines 3 and 15 from the bottom, in the Editorial Note, "The Forestry Act, 1919," for "a Forest Station" read "afforestation."

NOTICES OF BOOKS.

A Course of Practical Chemistry for Agricultural Students, Vol. 2, Part I.—H. A. Neville and L. F. Newman (Cambridge: University Press, 1919, 5s. net). Primarily designed for the use of students taking the degree in agricultural science at Cambridge, this series of laboratory exercises should also prove useful to agricultural students who have not taken a course in organic chemistry. The directions for practical work are accompanied by simple explanatory notes.

Land Drainage from Field to Sea.—C. H. J. Clayton, M.B.E., A.M.I.M.E. (London: "Country Life," Ltd., 1919, 6s. net). This work has been designed to convey in as popular and untechnical manner as possible some of the leading principles and items of practice which underlie the operations necessary to prevent the flooding and waterlogging of agricultural land. Although the sub-title "From Field to Sea" suggests the course naturally followed by drainage water, the subject is dealt with in the inverse order, with the object of emphasising the prime necessity of improving and maintaining the main outfall channels. The book contains an introduction by Sir Ailwyn Fellowes and a brief history of drainage legislation, and should appeal not only to agriculturists and landowners but to members of Drainage Boards, Commissioners of Sewers and County Drainage Committees.

Botany for Agricultural Students.—John N. Martin (New York, John Wiley & Sons, Inc.: London, Chapman & Hall, Ltd., 12s. 6d. net). The author, who is Professor of Botany in the Iowa State College of Agriculture, states that this book is intended for elementary courses in botany in colleges and universities. In its preparation the aim has been to present the fundamental principles of botany, with emphasis upon the practical application of these principles from the point of view of agriculture. The subject matter is presented in two parts. Part I. is devoted to the study of the structures and functions chiefly of flowering plants, and Part II. deals with the kinds of plants, relationships, evolution, heredity, and plant breeding.

Physiology of Farm Animals (Part I. General), T. B. Wood, C.B.E., and F. H. A. Marshall (Cambridge: University Press, 1920, 16s. net). This first volume, which is by Dr. Marshall, is addressed primarily to students of agriculture who may wish to obtain some knowledge of the simpler physiological processes as they occur in farm animals, but

it should be useful also to veterinary students. The animal organism is dealt with in successive chapters, commencing with the digestive organs and finishing with the female generative organs and the mammary glands. The book contains numerous diagrams and illustrations. The second volume, by Prof. Wood, on the subject of animal nutrition, will be published shortly.

Cattle and the Future of Beef Production in England.—K. J. J. Mackenzie (London: Cambridge University Press, 1919, 7s. 6d. net). In this book the author makes a strong plea for agricultural reform. He drives home the lesson, taught by the War, of the folly of relying upon other countries for food that might be produced at home. He specially urges the need of co-operation amongst farmers, of the development of "dual-purpose" cattle, and above all of systematic research on the part of scientists into the many problems of modern agriculture. Detailed descriptions of the principal breeds of cattle are given, while Dr. F. H. A. Marshall contributes a preface and a chapter on the physiological aspects of breeding.

It may be recalled that a résumé of a Report on "Beef Production," by Messrs. Mackenzie and Marshall, appeared in the issue of this *Journal* for September, 1918. It is hoped shortly to publish the full Report in the form of a *Journal* 'Supplement.'

Commercial Poultry Farming: being a description of the King's Langley Poultry Farm.—T. W. Toovey (London: Crosby Lockwood and Son, 1919, 7s. 6d. net). The purpose of this book is to give a plain, unvarnished account of the system of management and also, so far as possible, a detailed description of the plant of a large commercial poultry farm devoted to egg production. The system adopted is that known as the "semi-intensive," and the number of adult stock kept on the farm is 5,000 head, but the author states that it is not necessary that the operations should be so large, as the system is perfectly suitable to a small farm.

The World's Meat Future: an account of the live stock position and meat prospects of all leading stock countries of the world, with full list of freezing works.—A. W. Pearse (London: Constable & Co., Ltd., 1920, 21s. net). The author, who is editor of the *Pastoral Review*, deals in a comprehensive manner with the present position and future prospects of the meat industry. Principal attention is naturally devoted to the chief producing countries, Australasia, Argentina and the United States, but the author also examines the situation in the case of the smaller producers, especially those countries where the industry offers possibilities of expansion. Numerous illustrations of typical animals are given.

Report on Insect and Fungus Pests of Plants in 1918, Ministry of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1, price 6d., *post free*.—The second of a new series of Annual Reports on the distribution of insect and fungus pests of plants in England and Wales has just been published by the Ministry. It has been chiefly compiled from the records contained in Monthly Reports sent in by qualified observers stationed in different parts of the country, and it forms a comprehensive survey of the distribution and economic importance of plant pests during the year 1918. The Report is some-

what technical in character and is intended primarily for scientific workers on plant diseases and perhaps even more for those who will be engaged in this work in future. In addition to notes on the most important pests the Report gives the records in tabular form, so facilitating reference. For the convenience of readers weather charts have also been added.

A Handbook on the Law of Allotments.—E. Lawrence Mitchell (London: The Cable Printing and Publishing Co., Ltd., 1920, 6s. net). This book sets out in a concise manner the duties and powers of local authorities with regard to the provision of allotments. It contains the Rules and Regulations of the Ministry of Agriculture and Fisheries, the Provisions of the Small Holdings and Allotments Act, 1908, the Land Settlement (Facilities) Act, 1919, and the Acquisition of Land (Assessment of Compensation) Act, 1919, so far as these Acts relate to allotments. The book also contains an excellent index.

MISCELLANEOUS NOTES.

THE International Crop Report and Agricultural Statistics for January, 1920, published by the International Institute of Agriculture, gives particulars concerning the production of the cereal crops of 1919 in the Northern Hemisphere.

Notes on Crop Prospects Abroad.

Wheat.—For a group of countries representing about 60 per cent. of the world's yield, the production is estimated at 261,908,000 qr., or a decrease of 6·7 per cent. compared with 1918, the area sown being larger by 1·6 per cent.

Rye.—In respect of countries representing about 10 per cent. of the world's yield the estimated production is placed at 24,689,000 qr. in 1919, or an increase of 1·7 per cent. compared with 1918, the area sown showing an increase of 8·2 per cent.

Barley.—For a group of countries representing about 40 per cent. of the world's yield the production is estimated to amount to 68,087,000 qr., or a decrease of 20·4 per cent. compared with 1918, the area sown being smaller by 18·9 per cent.

Oats.—For a group of countries representing about 50 per cent. of the world's yield the production is estimated at 227,868,000 qr., or a decrease of 13·6 per cent. compared with 1918, the area sown showing a decrease of 2·9 per cent.

Maize.—For a group of countries representing about 75 per cent. of the world's yield the total production in 1919 is placed at 365,773,000 qr., or an increase of 15·2 per cent. compared with 1918, the area sown being smaller by 4·1 per cent.

Sowing of Winter Cereals in the Northern Hemisphere.—The areas estimated to have been sown with winter corn in 1919–20, compared with the areas sown during the corresponding period of 1918–19, expressed as percentages, are as follows:—*Wheat*: Belgium 99, England

and Wales 98, Canada (area sown up to November) 109, United States 77, Guatemala 101; *rye*: Belgium 101, United States 76; *barley*: Belgium 102.

Crops in the Southern Hemisphere.—The production of wheat in Australia in 1919-20 is estimated at 5,499,000 qr., against 10,102,000 qr. in 1918-19, or a decrease of 45·6 per cent., while the area sown with wheat in Argentina in 1919-20 is 11·9 per cent. less than in the previous year.

Prussia.—According to the Prussian Statistical Bureau the average condition of the grain crops in Prussia at the beginning of December was as follows (2=good, 3=average, 4=poor):—Wheat 3·2 (3·0, 2·6); spelt, 2·8 (2·6, 2·7); rye, 3·2 (2·9, 2·4); and barley, 2·9 (2·7, 2·3). The condition at the beginning of November, 1919, and December, 1918, respectively, is given in brackets. (*Broomhall's Corn Trade News*, 19th January, 1920.)

Sweden.—H.M. Minister at Stockholm reports that the production of the principal crops in Sweden, in 1919, is officially estimated (final figures) as follows (1918 figures in brackets):—Autumn wheat, 10,112,000 qr. (9,919,000 qr.); spring wheat, 1,771,000 qr. (1,331,000 qr.); autumn rye, 25,836,000 qr. (22,088,000 qr.); spring rye, 1,075,000 qr. (999,000 qr.); barley, 15,763,000 qr. (14,000,000 qr.); oats, 78,534,000 qr. (59,348,000 qr.); potatoes, 20,792,000 tons (19,047,000 tons); sugar beet, 8,985,000 tons (7,992,000 tons); hay, 42,318,000 tons (27,170,000 tons). The production of spring wheat and potatoes in 1919 is the largest on record.

France.—According to an estimate issued by the Ministry of Agriculture, the condition of the crops on 1st January, 1920, was as follows (figures for January, 1919 and 1918, in brackets):—Wheat, 68 (71 and 70); meslin, 69 (72 and 72); rye, 69 (73 and 72); barley, 68 (72 and 71); and oats, 69 (72 and 70). (80=good, and 60=fair.) The averages under the crops are as follows:—Rye, 1,958,000 acres; winter oats, 1,932,000 acres; winter barley, 346,000 acres; and meslin, 232,000 acres. (*Broomhall's Corn Trade News*, 9th February, 1920.)

According to the issue of the *Journal Officiel* of 5th February, the area sown with maize in France in 1919 was 739,794 acres, compared with 753,374 acres in 1918 and 1,126,567 acres in 1914, and the yield was 299,040 tons, as against 247,907 tons in 1918 and 572,294 in 1914. The area under buckwheat was 744,514 acres in 1919, compared with 768,812 acres in 1918 and 1,116,612 acres in 1914, and the crop amounted to 267,531 tons in 1919, as against 224,780 tons in 1918 and 532,401 tons in 1914. (*London Grain, Seed and Oil Reporter*, 9th February, 1920.)

India.—According to the first preliminary estimate, the area sown with wheat in India in 1919-20 is 27,429,000 acres, as compared with 23,403,000 acres, the first forecast last year, 23,764,000 acres, the final return last year, and 35,497,000 acres, the total area sown in the season 1917-18. (*London Grain, Seed and Oil Reporter*, 9th February, 1920.)

Canada.—The finally-revised official estimates of the production of the grain crops in Canada in 1919 are as follows:—Wheat, 193,260,000

bush, compared with 189,075,000 bush. in 1918; and oats, 394,387,000 bush. compared with 426,312,000 bush. (*London Grain, Seed and Oil Reporter*, 26th January, 1920.)

THE monthly crop report of the Ministry on 1st February was as follows :—The weather of January was mild but wet, and the rains hindered field work in all parts of the country.

Agricultural Conditions in England and Wales on 1st February. In the west little cultivation was possible, except on the lightest lands, but in the east conditions were rather more favourable, and fair progress was made, though heavy land was generally unfit to work. Cultivation is still fairly well forward for the time of year. Young crops have done well during the mild weather, though occasionally they have suffered from the wet on low-lying, heavy lands. Wheat is very promising, being regular and healthy, and oats are also satisfactory. Beans are a good plant, but are often backward.

Ewes are healthy, but they are not in good condition as a rule; they have generally suffered somewhat owing to the scarcity of keep and the wet weather, and have frequently lost condition during January. Lambing prospects are, however, considered favourable. The fall of lambs among early flocks has been satisfactory, and the young lambs are healthy and doing well.

The scarcity of winter keep is telling on other live stock also, and they are usually only in fair condition. The mild weather, which has allowed cattle to be kept in the fields to a greater extent than usual, has helped to conserve the small stocks of fodder, but supplies are still short, though the position in this respect is relatively easier than a month ago.

There is a sufficient supply of labour in practically all districts, but skilled men, more especially horsemen, cattlemen and hedge cutters, are not always available.

The following local summaries give details regarding agricultural labour in the different districts of England and Wales :—

Northumberland, Durham, Cumberland, and Westmorland.—The supply of labour is generally equal to the demand, but skilled men are still required in some areas.

Lancashire and Cheshire.—The supply of labour is on the whole about sufficient for requirements, though in some districts skilled men are scarce.

Yorkshire.—The supply of labour is, as a rule, sufficient; but horsemen, shepherds and cattlemen are in demand in some areas, and in one or two districts of the West Riding more casual labour is wanted.

Shropshire and Stafford.—The supply of labour is, as a rule, sufficient, but skilled men are still difficult to obtain in some areas of both counties.

Derby, Nottingham, Leicester, and Rutland.—The supply of casual and unskilled labour appears to be adequate, but there is still a shortage of skilled men.

Lincoln and Norfolk.—The supply of labour is generally regarded as adequate and only in a few districts is complaint made of the shortage of skilled men.

Suffolk, Cambridge, and Huntingdon.—The supply of labour is almost everywhere equal to the demand, and sometimes plentiful, though occasionally there is a shortage of skilled men.

Bedford, Northampton, and Warwick.—The supply of ordinary labour is sufficient, but skilled men are scarce in most districts, cattlemen, horsemen and hedge cutters being in demand.

Buckingham, Oxford, and Berkshire.—As a rule there is a sufficient supply of labour, but good cattlemen are difficult to obtain in some districts.

Worcester, Hereford, and Gloucester.—Labour is generally sufficient to meet present requirements, although in a few districts there is some difficulty in obtaining skilled men.

Cornwall, Devon, and Somerset.—Labour is now fairly plentiful, though there is still a demand for skilled men in most districts.

Dorset, Wiltshire, and Hampshire.—The supply of labour seems to be fairly abundant now, but skilled men, such as hedgers, and to a lesser extent milkers, are still scarce.

Surrey, Kent, and Sussex.—The supply of labour is generally sufficient, but in some districts skilled men, horsemen and cattlemen in particular, are in demand.

Essex, Hertford, and Middlesex.—The supply of labour is sufficient to meet requirements, but skilled men are still needed in some parts of Essex and Middlesex.

North Wales.—The supply of labour is, as a rule, sufficient, but skilled men, horsemen and stockmen particularly, are still in demand.

Mid Wales.—The supply of labour is considered sufficient in most districts, although skilled men are scarce in a few districts.

South Wales.—In some districts the supply of labour is sufficient for requirements, but in others there is a scarcity, especially of skilled men.

AVERAGE PRICES of British Wheat, Barley, and Oats at certain Markets during the Month of January, 1918, 1919, and 1920.

	WHEAT.			BARLEY.			OATS.		
	1918.	1919.	1920.	1918.	1919.	1920.	1918.	1919.	1920.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	74 4	73 1	72 10	59 2	62 5	111 4	54 2	62 5	62 5
Norwich ...	70 10	72 6	72 6	57 3	61 10	110 2	47 8	55 9	60 3
Peterborough	70 11	72 5	72 6	58 9	62 3	106 2	44 0	51 6	59 0
Lincoln ...	71 2	72 4	72 8	58 10	62 6	108 3	52 1	51 8	57 3
Doncaster ...	70 10	72 3	71 7	58 2	61 4	106 4	42 0	46 8	56 5
Salisbury ...	70 10	72 3	72 1	58 9	62 5	96 8	47 4	49 2	56 8

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1918, 1919 and 1920.

Weeks ended (in 1920).	WHEAT.						BARLEY.						OATS.					
	1918.		1919.		1920.		1918.		1919.		1920.		1918.		1919.		1920.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan. 3...	71	2	72	2	72	7	58	0	62	3	107	1	45	5	48	8	57	8
" 10...	71	2	72	6	72	6	58	2	62	5	109	7	46	9	49	8	57	7
" 17...	71	3	72	7	72	7	58	1	62	3	110	6	47	9	50	0	57	6
" 24...	71	1	72	7	72	7	58	7	61	10	108	11	48	2	49	6	57	10
" 31...	71	2	72	8	72	7	58	10	62	4	106	2	50	2	49	7	58	7
Feb. 7...	72	0	72	7	72	6	59	0	62	3	103	9	50	6	49	2	58	9
" 14...	72	3	72	8			58	11	62	5			52	0	49	0		
" 21...	72	2	72	8			58	9	62	6			52	3	49	4		
" 28...	72	2	72	7			57	9	62	7			52	0	48	8		
Mar. 6...	72	3	72	6			58	5	62	7			52	2	48	6		
" 13...	72	4	72	5			56	10	62	5			51	0	46	8		
" 20...	72	3	72	7			56	9	62	1			50	3	46	4		
" 27...	72	4	72	7			56	7	62	8			48	10	46	11		
Apr. 3...	72	11	72	6			56	7	62	8			49	10	47	2		
" 10...	73	3	73	0			56	6	62	9			47	2	47	1		
" 17...	73	3	73	1			56	6	62	9			47	0	47	3		
" 24...	73	3	73	1			56	10	62	9			46	8	48	1		
May 1...	73	5	73	2			56	5	62	8			47	4	48	7		
" 8...	73	5	73	2			56	6	63	1			47	6	47	5		
" 15...	73	4	73	3			56	6	62	4			46	4	47	11		
" 22...	73	3	73	2			56	6	62	7			47	8	47	11		
" 29...	73	8	73	3			60	0	62	7			44	9	48	3		
June 5...	73	11	73	2			59	2	62	6			45	5	47	10		
" 12...	74	3	73	3			57	9	62	8			45	7	48	11		
" 19...	74	4	73	3			58	5	62	8			47	8	48	7		
" 26...	74	4	73	3			57	10	63	4			46	4	49	1		
July 3...	74	4	73	4			61	7	62	4			46	10	49	0		
" 10...	74	4	73	3			57	5	63	1			47	0	49	11		
" 17...	74	3	73	4			60	5	62	9			45	4	49	11		
" 24...	74	3	73	4			56	11	63	4			46	2	48	11		
" 31...	74	3	73	3			57	1	62	10			45	10	50	3		
Aug. 7...	74	7	73	4			57	7	73	8			46	3	55	6		
" 14...	74	2	73	3			61	4	75	2			55	11	61	4		
" 21...	74	8	73	10			62	6	83	4			56	9	62	0		
" 28...	74	8	73	3			60	1	86	7			57	11	61	10		
Sept. 4...	72	3	73	4			60	4	89	3			56	9	61	1		
" 11...	72	5	73	5			60	1	92	5			49	2	62	4		
" 18...	72	6	73	4			60	4	94	7			49	11	61	3		
" 25...	72	7	73	0			60	3	95	2			50	3	60	2		
Oct. 2...	72	8	73	4			60	3	94	4			50	9	59	6		
" 9...	72	6	73	1			60	3	95	5			51	6	58	10		
" 16...	72	7	73	0			60	3	93	10			50	9	57	9		
" 23...	72	5	73	0			60	3	95	1			50	5	57	5		
" 30...	72	4	72	9			60	3	96	0			50	8	56	4		
Nov. 6...	72	4	72	8			60	3	97	10			49	11	55	3		
" 13...	72	5	72	7			60	3	100	7			49	10	55	7		
" 20...	72	4	72	7			60	10	104	11			51	1	55	11		
" 27...	72	3	72	7			62	2	107	9			50	4	56	0		
Dec. 4...	72	4	72	7			62	6	108	11			51	4	55	10		
" 11...	72	3	72	6			62	7	105	2			51	4	56	9		
" 18...	72	4	72	6			62	3	103	6			50	5	56	3		
" 25...	72	3	72	6			62	3	105	10			50	6	57	2		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

NOTE.—The above prices are based on returns received from Inspectors during the week named. They represent on the whole the average prices ruling in the

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in January, 1920, and December, 1919.

(Compiled from Reports received from the Ministry's Market
Reporters.)

Description.	JANUARY.		DECEMBER.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
	per cwt live weight	per cwt. live weight	per cwt. live weight	per cwt. live weight.
FAT STOCK:—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Cattle:—				
Poll'd Scots	84 10	80 0	83 1	77 3
Herefords	85 8	80 3	82 5	77 4
Shorthorns	84 9	79 9	82 5	77 4
Devons	85 3	79 9	82 1	77 1
Welsh Runts... ..	84 8	78 6	80 11	76 8
Fat Cows	79 8	71 8	77 4	69 3
	1st Quality. per lb.*	Second Quality. per lb.*	First Quality. per lb.*	Second Quality. per lb.*
	<i>d.</i>	<i>d.</i>	<i>d.</i>	<i>d.</i>
Veal Calves	19	16½	17½	15
Sheep:—				
Downs	16	16	15½	15½
Longwools	16	16	15½	15½
Cheviots	16	16	15½	15½
Blackfaced	16	16	15½	15½
Welsh.	16	16	15½	15½
Cross breeds	16	16	15½	15½
	per score. live weight	per score. live weight	per score. live weight.	per score. live weight.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Pigs:—				
Bacon Pigs	23 0	23 0	23 0	23 0
Porkers	23 0	23 0	23 0	23 0
LEAN STOCK:—	per head.	per head	per head	per head.
	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>	<i>£ s.</i>
Milking Cows:—				
Shorthorns—In Milk ...	58 1	43 17	58 17	44 2
— Calvers	54 10	40 1	53 1	39 13
Calves for Rearing ...	4 9	3 9	4 3	3 0
Store Cattle:—				
Shorthorns—Yearlings ...	15 7	12 16	15 1	12 4
— Two-year-olds ...	27 3	22 6	26 18	21 12
— Three-year-olds ...	35 12	31 3	37 9	33 4
Herefords—Two-year-olds	27 14	23 7	26 16	23 17
Devons—	27 17	22 16	27 8	22 16
Welsh Runts—	—	—	25 10	20 10
Store Sheep:—				
Hoggs, Hoggets, Togs, and Lambs—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Downs or Longwools ...	87 11	66 6	73 9	56 11
Store Pigs:—				
8 to 12 weeks old	56 7	41 8	47 0	33 10
12 to 16 „ „	100 9	80 10	92 10	72 11

* Estimated carcass weight.

NOTE.—The prices per lb. for sheep do not include the value of the skins, which during January, 1920, made prices equivalent to an additional 3½d. per lb. of the carcass weight for Downs, Longwools and Crossbreds, 2½d. for Welsh, 3½d. for Cheviots, and during December, 1919, 2½d. per lb for Downs and Blackfaced, 2½d. for Welsh and 3½d. for Longwools, Cheviots and Crossbreds.

**AVERAGE PRICES of PROVISIONS, POTATOES and HAY at
certain MARKETS in ENGLAND in January, 1920.**

*(Compiled from Reports received from the Ministry's Market
Reporters.)*

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER :—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
British	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
„ Factory	—	—	—	—	—	—
Imported (Controlled)	259 0	—	259 0	—	259 0	—
CHEESE—						
British—						
Cheddar	163 6	—	—	—	163 6	—
Cheshire	—	—	120 lb. 175 0	—	120 lb. 175 0	—
Canadian	163 6	—	per cwt. 163 6	—	per cwt. 163 6	—
BACON :—						
Irish (Green)	205 6	—	205 6	—	205 6	—
Canadian (Green sides)	192 0	—	192 0	—	192 0	—
HAMS :—						
York (Dried or Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green) (long cut)	195 0	—	195 0	—	195 0	—
EGGS :—						
British	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
Irish	—	—	—	—	50 0	—
American	39 0	—	50 0 39 1	— 37 10	50 0 40 0	49 0 38 0
POTATOES :—						
Arran Chief	per ton. 250 0	per ton. 220 0	per ton. 243 6	per ton. —	per ton. 260 0	per ton. 247 6
Edward VII.	290 0	268 6	280 0	268 6	275 0	262 6
Other Late Varieties...	282 6	257 6	206 6	186 6	260 0	245 0
HAY :—						
Clover	—	—	—	—	312 6	286 0
Meadow	—	—	—	—	306 0	282 6

**AVERAGE PRICES OF DEAD MEAT at certain MARKETS in
ENGLAND in JANUARY, 1920.**

*(Compiled from Reports received from the Ministry's Market
Reporters.)*

Description.	Quality.	Birming- ham.	Leeds.	London.	Man- chester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—					
English	1st	140 0	140 0	140 0	140 0
	2nd	140 0	140 0	140 0	140 0
Cow and Bull	1st	140 0	140 0	140 0	140 0
	2nd	140 0	140 0	121 6	121 6
Irish: Port Killed	1st	140 0	—	140 0	—
	2nd	140 0	—	140 0	—
Argentine Frozen—					
Hind Quarters	1st	126 0	126 0	126 0	126 0
Fore "	1st	98 0	98 0	98 0	98 0
Australian Frozen—					
Hind Quarters	1st	126 0	126 0	126 0	126 0
Fore "	1st	98 0	98 0	98 0	98 0
New Zealand Frozen—					
Hind Quarters	1st	—	—	126 0	—
Fore "	1st	—	—	98 0	—
VEAL :—					
British	1st	98 0	98 0	98 0	98 0
	2nd	—	98 0	98 0	98 0
MUTTON :—					
Scotch	1st	147 0	147 0	147 0	147 0
	2nd	147 0	147 0	147 0	147 0
English	1st	147 0	147 0	147 0	147 0
	2nd	147 0	147 0	147 0	147 0
Irish: Port Killed	1st	—	—	—	—
	2nd	—	—	—	—
Argentine Frozen	1st	98 0	98 0	98 0	98 0
New Zealand "	1st	—	—	98 0	98 0
Australian "	1st	98 0	98 0	98 0	98 0
LAMB :—					
British	1st	—	—	—	—
	2nd	—	—	—	—
New Zealand	1st	98 0	—	98 0	98 0
Australian	1st	—	98 0	98 0	98 0
Argentine	1st	98 0	98 0	98 0	—
PORK :—					
British	1st	—	—	163 6	—
	2nd	—	—	—	—
Frozen	1st	133 0	133 0	133 0	—

DISEASES OF ANIMALS ACTS 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Ministry of Agriculture and Fisheries.)

DISEASE.	JANUARY.	
	1920.	1919.
Anthrax :—		
Outbreaks	43	23
Animals attacked	48	24
Foot-and-Mouth Disease :—		
Outbreaks	24	12
Animals slaughtered as diseased or exposed to infection ...	1,277	744
Glanders (including Farcy) :—		
Outbreaks	3	—
Animals attacked	6	—
Parasitic Mange :—		
Outbreaks	837	868
Animals attacked	1,582	1,885
Rabies :—		
Number of cases	2	16
„ „ Dogs affected ...	2	15
„ „ other animals affected ...	—	1
Sheep-scab :—		
Outbreaks	140	103
Swine Fever :—		
Outbreaks	223	89
Swine slaughtered as diseased or exposed to infection ...	82	34

IRELAND.*(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)*

DISEASE.	JANUARY.	
	1920.	1919.
Anthrax :—		
Outbreaks	—	—
Animals attacked	—	—
Glanders (including Farcy) :—		
Outbreaks	—	1
Animals attacked	—	2
Parasitic Mange :—		
Outbreaks	21	11
Sheep-scab :—		
Outbreaks	51	71
Swine Fever :—		
Outbreaks	1	5
Swine slaughtered as diseased or exposed to infection ...	4	13

The Weather in England during January.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending 3rd Jan.:								
England, N.E. ...	38·1	-0·1	0·75	19	+7	4	1·0	-0·1
England, E. ...	40·2	+2·1	0·79	20	+8	5	1·0	-0·2
Midland Counties ...	39·5	+1·6	0·82	21	+6	5	0·8	-0·3
England, S.E. ...	41·7	+1·8	1·21	31	+16	6	0·9	-0·4
England, N.W. ...	40·0	+0·1	0·91	23	+4	5	1·1	+0·1
England, S.W. ...	41·4	+0·9	2·02	51	+26	7	0·9	-0·4
English Channel ...	46·0	+0·9	2·01	51	+30	7	1·1	-0·7
Week ending 10th Jan.:								
England, N.E. ...	37·4	-0·5	0·66	17	+4	4	1·5	+0·4
England, E. ...	37·4	-0·3	0·55	14	+1	3	1·8	+0·4
Midland Counties ...	37·4	-0·3	0·99	25	+10	4	1·3	+0·2
England, S.E. ...	38·3	-1·2	0·93	24	+10	4	1·8	+0·3
England, N.W. ...	38·6	-0·7	1·01	26	+7	4	0·7	-0·4
England, S.W. ...	39·3	-1·0	1·70	43	+20	4	2·2	+0·7
English Channel ...	43·0	-1·8	0·68	17	-3	4	2·4	+0·0
Week ending 17th Jan.:								
England, N.E. ...	43·5	+5·7	0·39	10	0·0	4	1·7	+0·6
England, E. ...	45·3	+8·1	0·50	13	+3	5	1·0	-0·6
Midland Counties ...	46·0	+9·0	0·44	11	0·0	5	1·4	+0·1
England, S.E. ...	46·9	+8·1	0·67	17	+5	5	0·9	-0·7
England, N.W. ...	44·7	+5·7	0·72	18	+3	5	1·4	+0·2
England, S.W. ...	46·9	+6·4	1·16	20	+10	6	0·9	-0·7
English Channel ...	48·0	+4·1	1·15	29	+11	6	1·0	-0·0
Week ending 24th Jan.:								
England, N.E. ...	42·2	+3·0	0·40	10	+2	5	2·0	+0·5
England, E. ...	42·4	+3·7	0·29	7	-2	4	1·4	-0·1
Midland Counties ...	43·3	+5·4	0·24	6	-4	5	1·3	-0·1
England, S.E. ...	43·8	+4·5	0·22	6	-6	5	1·4	-0·2
England, N.W. ...	43·7	+4·1	0·93	24	+8	5	1·6	+0·3
England, S.W. ...	45·2	+4·1	0·36	9	-9	5	1·7	+0·2
English Channel ...	46·5	+2·3	0·39	10	-4	5	2·3	+0·3
Week ending 31st Jan.:								
England, N.E. ...	39·7	+1·2	0·86	22	+13	6	2·5	+0·8
England, E. ...	41·3	+3·0	0·82	21	+12	5	2·4	+0·3
Midland Counties ...	41·1	+2·7	1·47	37	+25	6	2·5	+0·9
England, S.E. ...	43·3	+3·7	1·30	33	+21	6	2·6	+0·7
England, N.W. ...	41·5	+1·8	1·24	32	+14	6	1·7	0·0
England, S.W. ...	43·5	+2·5	1·99	50	+29	7	2·1	+0·3
English Channel ...	45·8	+1·6	1·42	36	+20	6	1·9	-0·4

* 1 inch = 25·4 millimetres.

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

- The Use of Electricity in Agriculture, with special reference to its Development in Germany, *J. F. Crawley*. (Jour. Roy. Soc. Arts, 26th September, 3rd and 10th October, 1919.) [63.17(04).]
- Further Studies on the Soils of N. Wales, *G. W. Robinson* and *C. F. Hill*. (Jour. Agric. Sci., September, 1919.) [63.111.]
- Untersuchungen über die Konservierung der Jauche durch verschiedene Zusatzmittel, *O. Lemmermann* und *H. Wiessmann*. (Landw. Jahrb. LII. Bd., Heft 3, 1918.) [63.163.]
- The Amount and Composition of Rain Falling at Rothamsted, *E. J. Russell* and *E. H. Richards*. (Jour. Agric. Sci., October, 1919.) [551'5.]
- The Effect of Potassium Salts on the Anatomy of *Dactylis glomerata*, *O. N. Purvis*. (Jour. Agric. Sci., October, 1919.) [63.1673.]
- Observations on Soil Protozoa, *D. W. Culler*. (Jour. Agric. Sci., October, 1919.) [63.115.]
- A Note on the Capillary Rise of Water in Soils, *B. A. Keen*. (Jour. Agric. Sci., October, 1919.) [63.112.]
- A Quantitative Relation Between Soil and the Soil Solution brought out by Freezing-Point Determinations, *B. A. Keen*. (Jour. Agric. Sci., October, 1919.) [63.112.]
- Zur Methodik der physikalischen Bodenanalyse, *P. Koettgen*. (Internat. Mitt. Bodenkunde, Bd. VII., Heft 5/6, 1917.) [63.113.]
- Nitrogen Losses in Urine, *F. E. Bear* and *J. R. Royston*. (Jour. Amer. Soc. Agronomy, November, 1919.) [63.163.]
- Vorschriften für das Entnehmen und Einsenden von Untersuchungsproben landw. wichtiger Stoffe. (Land. Versuchs-Stationen, Band XCIV., Heft 3 & 4, 1919.) [343.53(d).]

Field Crops—

- The Value of Lupins in the Cultivation of poor, light Land, *A. W. Oldershaw*. (Jour. Roy. Soc. Arts, 26th September, 1919.) [63.165.]
- The Distribution of Dry Matter and Nitrogen in the Potato Tuber variety, King Edward. *M. D. Glynn* and *V. G. Jackson*. (Jour. Agric. Sci., September, 1919.) [63.512(04).]
- Die Verluste bei der Dürreheubereitung und die Sauerfutterherstellung. *Dr. Ahr* and *Dr. Mayr*. (Fühling's Land. Zeitung, 1/15 Mai, 1917.) [63.198.]
- Breeding Timothy at Svalöf, *H. Witt*. (Jour. Heredity, October, 1919.) [63.33(d).]
- Oat Growing Experiments in Scotland, *J. A. Simon*. (Scott. Jour. Agric., October, 1919.) [63.314.]
- The Composition of Linseed recovered from Home-Grown Flax, *T. W. Fagan*. (Scott. Jour. Agric., October, 1919.) [63.3421.]
- The "Jerusalem Artichoke," *C. C. Lacaita*. (Roy. Bot. Gard., Kew, Bull. Misc. Inform., No. 9, 1919.) [63.511.]
- Trocknungsverfahren bei Getreidegarben, *R. Sheppes*. (Deutsche Landw. Presse, 20th September, 1919.) [63.198.]
- Das Problem der Akklimatisation der Sojabohne in Deutschland, *Dr. Baumann*. (Fühling's Land. Zeit., 1/15, Oktober, 1919.) [63.321.]
- The Future of Wheat Production with special reference to the Empire. (Bull. Imp. Inst., Vol. XVII., No. 2, April-June, 1919.) [63.311.31.]

Dairying and Food, General—

- Variation of Ayrshire Cows in the Quantity and Fat Content of their Milk, *R. Pearl* and *J. R. Miner*. (Jour. Agric. Research, 13th September, 1919.) [63.711(b).]

Veterinary Science—

- Some Cases of Buttercup Poisoning in Cattle, *W. S. Mulvey*. (Vet. Jour., August, 1919.) [63.255.]
- Influence of Mines upon Land and Livestock in Cardiganshire, *J. J. Griffith*. (Jour. Agric. Sci., October, 1919.) [614.7.]

Birds, Poultry and Bees—

- Nosema Apis in Hive Bees, *J. Rennie* and *Elsie J. Harvey*. (Scott. Jour. Agric., October, 1919.) [63.81.00.]

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NOTES.

Two important announcements in regard to the prices of wheat harvested in 1920 and in 1921 have been made by the Government

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The Prime Minister, in the House of Commons, on the 12th March, said:—

Price of the 1920 Wheat Crop. "In order to remove the anxiety which has been expressed by farmers with regard to the price of the 1920 wheat crop, the Government has decided that, so long as wheat is still controlled and thereby deprived of a free market, the controlled price of home grown wheat of sound milling quality, harvested in 1920, shall be the monthly average (c.i.f.) price of imported wheat of similar or comparable quality, provided that the price so paid to the home grower shall not exceed 95s. per qr. of 504 lb."

With regard to the price for the 1921 crop, the following announcement has been approved by the Cabinet:—

Price of the 1921 Wheat Crop. "It is hoped that before the Autumn of 1921 the importation and control of the price of wheat by the Government will have ceased, and that farmers will secure the benefit of a free market at world's prices."

So long as wheat is still controlled, and thereby deprived of a free market, the controlled price of home-grown wheat of sound milling quality, harvested in 1921, will be the average (c.i.f.) price for the twelve months ending 31st August, 1921, of imported wheat of similar or comparable quality, provided that the price so paid to the home grower shall not exceed 100s. per qr. of 504 lb."

THE Cabinet has come to two other decisions with regard to the control of agricultural produce. The great decline in the pig population of the United

Decontrol of Pigs. Kingdom, which has been one of the unfortunate results of control of both market and price, is a matter of national concern. It has not only injured the agricultural industry but has made the consumer increasingly dependent upon imported bacon, which is not agreeable to his taste. With a view, therefore, to stimulating the breeding of pigs, and a supply of fresh pork and bacon for the British consumer, the Cabinet has decided that *home-grown pigs and pig products shall be decontrolled from 31st March.*

* * * * *

THE Government had also been prepared to decontrol all other home-grown meat on 1st February, and has been strongly urged in this direction by the

Decontrol of Home-grown Meat. National Farmers' Union, the Royal Agricultural Society, and other responsible bodies representing the English and Welsh farmers. Vehement objection, however, in the removal of control was taken by the Scottish and Irish farmers, and, although the Cabinet was of the opinion that decontrol would have operated to the advantage of both producer and consumer, it was felt that it would be better to forego that advantage, rather than to give any excuse for a charge of 'breach of faith which might shake the confidence of the agricultural community in the undertakings of the Government. The existing control of home-grown meat will therefore continue until 4th July, when a free market will be restored.

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SOON after the Armistice it was decided to bring the Government Tractor and Horse Schemes to an end. It was realised,

Tractor and Horse Schemes. however, that the transition from public to private ownership could only be effected gradually. The Government necessarily had to execute the contracts in hand and provide for those farmers who were relying upon State assistance for the coming year. Consequently, only a few tractors and horses were sold before the completion of the 1919 spring cultivations, a sufficient force of tractors and horses being retained to assist those farmers who would otherwise have been

unable to carry out the work until the harvest was gathered. One or two counties had nearly a full complement of tractors for the whole period; some were able to dispense with any further help after the spring cultivations; others retained horses and dispensed with tractors.

The process of liquidation has thus been drawn out for more than a year, but is now practically completed. All horses have been sold, and only a few tractors and implements remain on hand for disposal. All tractors worth repairing were put in running order before the sales, which were held in the localities where they had been working. Horses were carefully "vetted" before being sold. The interval between the use of tractors and horses under the Government Scheme and their use in private ownership was thereby made as short as possible. That these measures were successful is shown by two facts:—(1) high prices were realised at the Government sales—in some cases more than the original cost; and (2) there was an almost entire absence of complaints, although it was anticipated that a certain amount of hardship in individual cases would result when the Government Schemes came to an end.

UNDER the Ministry of Agriculture and Fisheries Act, 1919, the County Agricultural Committees which are to be formed are charged with the duty of making **County Agricultural Committees and Village Life.** "such inquiries as appear to them to be desirable with a view to formulating schemes for the development of rural industries and social life in rural places, and for the co-ordination of action by local authorities and other bodies by which such development may be affected." The Committees are enjoined "to report the result of such inquiries to the Ministry and to any local authority or body concerned, and the expenses incurred by the Committee under this sub-section, to such amount as may be sanctioned by the Ministry with the approval of the Treasury, shall be defrayed by the Ministry."

These Committees are thus given an important duty to perform, and if they address themselves to it with ardour and determination, they will do a great deal towards brightening and enriching village life. Apart from the starting of new rural industries in suitable localities, efforts are called for to induce manufacturers, whose goods can be made in the homes of cottagers, to open branches of their factories in rural areas.

In Dorset and Somerset there is a great deal of net braiding and gloving in cottage homes, and probably other manufacturers could get work done quite reliably by taking it to the people, instead of bringing people from rural districts to work in large and already congested areas of population. It is not, of course, suggested that competitive forms of labour are required in the country; occupations are sought which may afford employment to the women and young girls. Experience has shown that if the latter migrate to the towns, the youths follow. If, therefore, employment can be found for the girls, something will be done towards checking the movement from field to factory which has, of late years, been so unfortunate a feature of our national life.

THERE is still a certain amount of criticism made as to the measures being taken to check the spread of Wart Disease.

Wart Disease. In these circumstances it is well that the official attitude should be understood.

In the first place, it is important that clean parts of the country should be protected from infection. Were they to become badly infected, the existence of immune varieties would still suffice to save the potato-growing industry carried on there, but an immediate stop would be put to the cultivation of those varieties eminently suitable to local conditions. For example, in the Fen country, the "King Edward" and "Evergood," both unfortunately susceptible to Wart Disease, grow better than any others. Moreover, there is a very large demand for them all over England, with the exception of certain districts in the Ridings of Yorkshire and in the South-Western counties. Even in these districts, in which there is no marked local demand, large quantities of "King Edward" are grown to meet the demand elsewhere.

The Ministry has come to the conclusion that the main cause of the spread of Wart Disease is the planting in clean areas of susceptible varieties of potatoes obtained from infected or suspicious districts. Their policy has, therefore, been not only to make it illegal to use as seed for clean land potatoes which have been grown on infected land, but also to limit the cultivation of potatoes on infected land to immune varieties. The latter regulation has certainly prevented the wide distribution of disease that would have been entailed by the common practice of using ware potatoes as seed, but it has also involved some hardship on the grower for market by

preventing the cultivation of certain susceptible varieties which in his opinion are best suited to his land and to his markets.

Were the planting of susceptible varieties in infected and suspicious districts to be allowed, the free distribution of the crop for any purpose would involve a grave manacle to clean areas, and distribution would have to be restricted to markets in districts already infected. This interference with the trade in *ware* potatoes might inflict more hardships upon growers in infected districts and cause more discontent among consumers than does the present policy.

No alteration of the Regulations is contemplated during the forthcoming season, but the Technical Advisers of the Ministry are giving full consideration to the question of the possibility of any alternative policy, which might, without introducing other hardships, dispense with those at present entailed, and so be acceptable to the potato industry generally.

THE total area of land acquired to date by the Ministry for Farm Settlements for ex-Service men is 25,693 acres,

Farm Settlements. comprising 15 different properties. Vacant possession of the land will be obtained as follows:—Already obtained, 14,480 acres; by Michaelmas, 1921, 6,348 acres; subsequently, 4,865 acres.

On the profit-sharing settlement at Patrington, which was the first estate acquired, 63 ex-Service men are now employed, 37 of whom have completed their 6 months' probationary period, and are, therefore, entitled to share in the profits on the farming operations. The development of the small holding settlement at Holbeach is also in an advanced stage, as 75 small holdings have already been let to ex-Service men, and a further 7 men are working on probation on the central farm. The small holders on this settlement have formed a co-operative society affiliated to the Agricultural Organisation Society. Although possession of the estate at Titchfield was obtained only on 29th September last, there are now 78 ex-Service men with small holdings, and 38 others employed on the central farm or on the estate work. The principal crop at this settlement is strawberries, as the estate is situated in the strawberry-growing district of Hampshire. A Co-operative Society has just been formed.

The settlements at Bosbury and Wantage are being specially set apart for ex-officers. At the former, there are at present 7 ex-officers with small holdings and 2 employed on the central farm, and at the latter 8 ex-officers working on the profit-sharing farm. At Wantage, 12 ex-land army women are also working on probation. The Ministry is endeavouring to increase the number of openings available for women who have served in the forces or have been engaged on agricultural work during the War, and it is hoped to take a small number of women at each of the settlements.

A fine agricultural estate at Sutton Bridge (Lincs) has been purchased from the governors of Guy's Hospital. It covers 6,542 acres, practically arable land, alluvial in character, and of a most fertile nature, eminently suitable for intensive cultivation and capable of producing heavy crops of potatoes, fruit, and other market-garden products. It is ripe for closer settlement and offers a unique opportunity for the development of small holdings on co-operative lines. No ex-Service men have yet been settled on this estate, as vacant possession of the first portion of the land will not be obtained until April next.

The Ministry has also purchased an estate at Wainfleet (Lincs) comprising 1,778 acres. It will provide about 30 small holdings of from 30 to 40 acres in extent suitable for mixed farming, the Ministry retaining a portion of the land for a central farm. About 250 acres of the estate will come into hand at Lady Day next, and the remainder at Michaelmas.

The total number of ex-Service men who have been received at the settlement is 536, of whom 84 have left for reasons of ill-health, etc., leaving 452 at the settlements at present. This number is made up of 271 settlers, 107 probationers, and 74 other ex-Service men working as wage-earners. The settlers consist of 200 men provided with small holdings, and 71 men on profit-sharing farms who have completed their six months' probationary period. The small holdings provided comprise in all 1,971 acres. In addition, 12 ex-land army women have been settled at the Wantage Farm Settlement which is devoted to dairying, and 1 at the Pembrey Farm Settlement in South Wales.

Progress with the development of all settlements has been greatly hindered by difficulties of housing accommodation. The estates when purchased are equipped only with the number of houses and cottages necessary for extensive farming, and

many of them are in a bad state of repair. In addition to new cottages, considerable repairs and alterations to existing buildings have been necessary. In several instances army huts have been erected and used as hostels until other accommodation is available. At each of the settlements at Amesbury and Rolleston 2 army huts have been erected as bungalows for married men and their families. Thirty-six and 56 new cottages have been completed by the Ministry at Patrington and Holbeach respectively, and are now occupied by settlers and their families. Sixteen cottages are in course of erection at Pembrey, 14 at Rolleston, and 25 at Amesbury. At Amesbury, 9 new cottages are now nearly ready for occupation.

EXPERIMENTS on the soiling of milch cows have been carried out at the Harper Adams Agricultural College since 1915.

**The Harper
Adams
Soiling Experiment.**

The first experiment was designed to test the possibilities of producing the green food for stock usually supplied by grass during the summer months. The results may be said to have shown that, with a proper rotation and suitable succession of crops, arable land possesses a great advantage over even the richest grass in ability to maintain a large head of stock per acre. This investigation has been continued with a view to testing the possibility of maintaining dairy cows entirely on arable land throughout the year. It is a method which is little practised in British farming, but the results have proved the complete success of the system, for winter as well as for summer fodder.

The result of the whole series of experiments shows that milk production on arable land can be practised with success and with every prospect of profits equivalent to those obtained in other systems of farming. Cost of labour per gallon of milk is not greater with the soiling system than with other methods of farming. Much labour usually employed in ordinary farming is dispensed with; the crops are cheap to grow, and can be fed without chaffing or pulping; in addition, the system lends itself to a more perfected organisation than is possible in the usual method of farming.

The plan of working was as follows. A field of the lightest sandy soil was sown as early as possible with a mixture of peas and oats to provide hay for the winter months. For the production of green fodder a field was set apart and divided

into eight plots, each plot producing forage to supply 10 cows 14 to 21 days. Such an arrangement provided a continuous supply of fresh green fodder throughout the summer. Five of the eight plots were ploughed up and planted with cabbage immediately the first crops were off the ground, that is to say, at intervals from May to September, the remaining three plots being sown with mixtures in the autumn to provide the first crops for the following year. The soiling succession of crops on the eight plots was mixtures on the following:— (1) giant rye, winter vetches; (2) giant rye, field peas; (3) winter oats, winter barley, winter vetches; (4) wheat, winter vetches; (5) oats, field peas; (6) barley, field peas, vetches, field beans, oats; (7) oats, field peas; and (8) maize.

During the summer period the green fodder crops were fed to the cows, with the addition of pea and oat hay; the second crops, viz., cabbages, were fed from October to February, in conjunction with pea and oat hay, and, finally, mangolds and pea and oat hay were used from February to May.

The cows kept in good condition on the food, and gave high yields of milk when consuming only 70 lb. of fodder per head per day, while it was found that, in the case of certain crops, they would eat as much as 120 lb. per day. From 80 lb. to 90 lb. seems to be all that is actually required under ordinary circumstances. When fodder is abundant it is advisable to give the cows all they will eat.

As regards yields of milk, in the summer of 1917 499 gal. were obtained per acre, as against 198 gal. from similar land in grass. In 1918 13 cows kept on the system throughout the year consumed the produce of 15½ acres, including 7 acres of pea and oat hay and 1 acre of mangolds. Cake and meal at the rate of 4 lb. per head per day were supplied in addition. The yield of milk per cow during the year worked out at 625 gal., and 548 gal. per acre for the land involved.

The experiments appear to show that a succession of fodder crops can be grown on arable land, which will maintain milch cows in perfect health and profit throughout the year without the employment of any grass land whatever.

Cows kept on the soiling system without any grazing and with the minimum of exercise, milk well and keep in good condition. The calves produced are healthy and grow well.

It also appears that land under forage crops practically cleans itself of weeds and can be successfully farmed without the rotation system. The soiling system is financially sound,

and can be generally recommended in suitable districts, especially in regions with a high rainfall where cereal growing is risky.

By adopting the soiling system it is possible to increase production over what can be obtained from the established four-course rotation, the latter being most profitable with medium rather than high farming. The soiling system increases production, and at the same time lowers costs per unit of produce. The success of these experiments suggests a new standard in farming, the ultimate possibilities of which cannot be gauged.

Arable land dairying offers a hopeful opportunity for an immediate increase in the output of British agriculture, as well as the profitable employment of capital, the regeneration of the countryside, and the home production of essential human food.

* * * * *

DURING the War women who volunteered for service on the land to help in the emergency, and wished after the War to farm on their own account, were promised special facilities. In pursuance of this promise the Women's Branch of the Ministry and County Committees in charge of the Land Army considered the establishment of a number of farms to be run by women as a preliminary to successful land settlement. Financial difficulties delayed the scheme for some time, but it was finally decided that the Women's Branch and the Women's Committees might take over the working of certain derelict farms if they were prepared to do so. These farms had been taken from their tenants by the County Executive Committees under the Defence of the Realm Regulations, and were, therefore, some of the worst cultivated in their respective counties. In spite of these difficulties the women undertook the work, and the following farms were taken over :—

**Farms cultivated
by Women.**

- (a) Moor House Farm, Scruton, Yorkshire. (140 acres.)
- (b) Creech Barrow Farm, Somerset. (10 acres, all grass.)
- (c) Grove Farm, Newport, Mon. (150 acres.)
- (d) Great Bidlake, Devon. (134 acres.)*
- (e) Common Farm, Church Hill, Worcestershire. (161 acres.)

Of these only the Somerset and Devon farms were not derelict. The management of each farm was entrusted either to the

* An article on the cultivation of this farm was published in this *Journal*, October, 1918, p. 834.

County Agricultural Executive Committee, the Women's Committee, or a Farm Committee consisting of women and local farmers with (in some cases) a neighbouring farmer as supervisor, and a working forewoman.

Neglected land under divided control was bound to possess disadvantages of the worst kind, and on much that was taken over there could have been no possible question of profit-making. The results are very interesting. On the Yorkshire farm in less than a year the War Agricultural Executive Committee reported to the Ministry that great improvement in the cultivation of the land had been effected, and that it was now in a fit state to be re-let; there was no loss on the working. On the small farm in Somerset, a loan of £250 was repaid with interest and a profit of £15 made in ten months. The land at Newport was in a starved and dirty condition, houses and drainage were in a very unsatisfactory state, and there was a considerable loss on the working, but the Executive Officer reported that the condition of the land had been improved. The Devon farm was held for two years most successfully, and Professor White, who inspected the farm, reported to the Ministry that the condition of the crops and the farm as a whole reflected great credit on the management, and that the farmyard was one of the best he had seen in the summer of his visit. The farm in Worcester, taken over in 1918, is still in hand.

It will be seen from this brief summary of results that the experiment of putting farms under the control of women workers has been very largely successful, and has demonstrated the ability of women who have had no previous training, but are full of the desire to become farmers, to overcome obstacles that must fairly be regarded as rather out of the common.

A CORRESPONDENT recently wrote to the Ministry to ask why it was considered necessary for the Government to give financial support to milk recording societies. Doubtless there are many people who have considered the question, and it may be of interest to set out the very simple reasons. The principle of keeping milk records of cows is one that every dairy farmer should follow in his own interest, but the work has not been done systematically or scientifically to any great extent in this country, and it is very unlikely that it would ever have been taken up had not the Government decided to give dairy farmers

advice and encouragement in the interests of national milk production. In order to secure increased milk production it is very desirable to eliminate the bad milker, and the best way to secure this end is to keep a careful record of the yield of every cow in the herd. In this connection it may be stated that the yield of milk of a cow cannot be determined by the size of the animal's udder, as is so commonly believed by farmers. The well-bagged cow is sometimes a poor milker. Inasmuch as the Government wish to encourage increased milk production in the national interest, the expenditure of public money spent for this purpose is justified. Although the Milk Recording Scheme has only been in operation for a few years, there is every reason to believe that the value of it is appreciated in many districts, and that many new societies are likely to be formed at an early date. It may well be that when farmers have proved that financial benefit does accrue from keeping milk records, they will be ready to carry on with less financial assistance than they now receive. Those who have seen a milk recording certificate will doubtless have noticed that it certifies (a) that the records were kept under the supervision of a milk recording society; (b) that they were subject to inspection without notification by an approved recorder; and (c) that they showed that the yield of milk amounted to so many pounds during the year. Every precaution has been taken to secure absolute accuracy for the information given on the certificate, but the Ministry cannot give guarantees, and does not wish to render itself liable for payment of compensation to which the purchaser of a certificated cow might think himself entitled if the cow was not up to the standard expected. The Ministry, therefore, safeguards itself by issuing a statement in the "Register of Dairy Cows" that it accepts no responsibility for any inaccuracy. At the same time, needless to say, there is very little room left for inaccuracies to creep in.

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THE following note has been communicated to the Ministry by Captain J. A. Symon, D.S.O., M.A., B.Sc. :—

**A Farm Institute
in Somerset.**

The Somerset County Council have now taken possession on leasehold tenure of the old mansion house and gardens known as Cannington Court, Cannington, some 3 miles from Bridgwater, for the purpose of establishing a Farm Institute. They have also acquired a lease of the adjoining Court Farm of upwards of 178 acres, one-half being arable.

From an historical point of view the present buildings are extremely interesting. Founded about the middle of the 12th century they were used for some centuries, until the dissolution of the monasteries, as a Benedictine Nunnery. Afterwards they passed into the hands of the Roger family, but at the time of Charles II. the estate reverted to the Crown on account of there being no male issue. It then came into possession of the Clifford family, and for nearly a century and a half was used as the family residence of Lord Clifford. In the 19th century the buildings were again used as a nunnery and afterwards as an industrial school for Catholic boys.

On the completion of certain alterations there will be residential accommodation for the staff, and for 20 male and 10 female students, as well as suitable class rooms, laboratories, a large dairy, and a carpenter's and blacksmith's shop.

The courses of instruction are as follows:—The normal course for male students will extend over two winter terms of about 14 weeks each, and will comprise instruction in such subjects as agriculture, agricultural and veterinary science, farm accounts, surveying and horticulture. Part of each day will be devoted to practical work on the farm and in the gardens and workshops. A third or summer term will be provided for such male students as desire to complete a year's training on the farm.

The usual course for female students will extend over one term of 14 weeks. Instruction will be provided in dairying (including cheese- and butter-making), domestic science and poultry-keeping. A senior course will be provided for such students as desire to remain for an additional term.

For county students the fee will be £1 per week, this sum covering payment for board and lodging and instruction. Students from other counties will be admitted, provided there are vacancies, at a fee of £1 10s. per week. A certain number of free places will be open to county students.

The object of the instruction given at the Institute will be primarily to prepare young men and women for the daily routine work on the farm or in the farm household. With this end in view theoretical instruction will be co-ordinated with the practical work of the farm. Thus in book-keeping actual farm figures and accounts will be utilised. The management of the different crops and stock kept on the farm, the carrying out of experiments, the actual handling of labour and the care and management of the gardens and orchards, will all form the foundation of the theoretical instruction pro-



Cannington Court, near Bridgwater, leased by the Somerset County Council
for a Farm Institute.

vided in the class room. In the case of female students instruction will be confined to plain cooking and laundry, to the making of the common varieties of cheese in the county, and the keeping of poultry on either up-to-date farmyard principles or on the colony system. Promising students who intend taking extended courses of instruction at universities or agricultural colleges will be encouraged by scholarships to do so. Continuity will in all cases be aimed at. Thus the Institute will work hand in hand with the rural science schools and the rural evening classes on the one hand, and the university or agricultural colleges on the other.

It is expected that the Institute will be in full working order by the spring of 1921. In the meantime the buildings and gardens are being utilised as a training centre for ex-Service men in horticulture and poultry-keeping.

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INCREASING interest is being taken by farmers and commercial fruit and vegetable growers in science as applied to cultivation.

Plant Hygiene. Both old established societies—content in the past with their practical knowledge of crop cultivation—and newly formed societies—anxious to base their operations on scientific lines—are asking for lecturers who can demonstrate to them the advantages of the combination of theory and practice. The Ministry welcome such requests, and are endeavouring to meet them as far as possible.

In the middle of January a lecture was delivered in Norwich by Mr. G. C. Gough, B.Sc., an Inspector of the Ministry, on the subject, "Plant Hygiene in relation to Crops." Mr. Gough first pointed out that *cleanliness* is as important to plants as to human beings, and gave instances of the large losses sustained in this and other countries from the depredations of the pests and diseases of plants and crops.

With regard to *measures of control*, the lecturer considered the subject under the four headings: (1) exclusion, (2) protection, (3) eradication, (4) immunisation. Under the first of these he dealt with the necessity of suitable crop rotation, whereby the succession on the same land of crops subject to the same pest was avoided; the advantages of reasonable separation when planting patches of such crops as bush fruit, in view of the possibility of epidemic outbreaks of disease; and the need for care in the purchase of seed, bushes or fruit-tree stocks to avoid the introduction of disease. Mr. Gough emphasised the large extent

to which nurseries and seed firms are involved in this question, and in pointing out that the grower deserves every assistance to obtain clean and good material, he foreshadowed the probability of legislation to deal with this aspect of the matter.

Under the heading of *protection*, the lecturer drew attention to the necessity of proper watering and ventilation for crops under glass, and the advantages of spraying and of soil sterilisation as an insurance against the attacks of insects, fungi, etc.

It is difficult to draw a line between measures of protection and of eradication, and certain measures included by the lecturer under the latter heading apply equally to the former. Under whatever heading they are included, they constitute some of the most important precepts of plant hygiene, and the danger was emphasised (1) of permitting the rubbish heap to become the manure heap, and thus the breeding place of obnoxious plant pests, and (2) of feeding pigs and other animals on diseased food plants that had not been boiled. The lecturer pointed out that the passage of fungus spores, unharmed, through the digestive system of animals, entailed their return to the land under conditions extremely favourable to the vigorous recurrence of disease.

Referring to the question of *pruning*, the lecturer urged its importance from the point of view of the removal of diseased wood, as well as from the purely cultural standpoint, and pointed out that to prune away diseased material without also burning it was but labour in vain. Mr. Gough also spoke at some length on the value of contact and poison insecticides and of the winter washing of fruit trees.

Of all matters relative to plant hygiene, the breeding of varieties immune from disease presents, perhaps, the largest field to the scientific investigator. The lecturer demonstrated by reference to those varieties of potato immune from Wart Disease that absolute immunity is an established fact; he pointed out the desirability of breeding varieties of crops immune from all the diseases to which they are at present liable, and also of combining this general immunity with good cropping and feeding qualities.

While it would be unwise to lose sight of the necessity of careful drainage, cultivation, manuring, etc., in the raising of healthy crops, attention to the measures outlined by Mr. Gough will be of increasing benefit to the grower and to the nation.

THE campaign by the Ministry for the improvement of grass land in this country, outlined in a note in the issue of this

**The Improvement
of Grass Land.**

Journal for last month (p. 1058), was inaugurated on Saturday, 14th February, when Dr. Somerville, Sibthorpe Professor of Rural Economy in the University of Oxford, delivered an address at Leicester to a large gathering of farmers under the chairmanship of Sir Thomas Cope, Bart., Chairman of the Leicestershire County Council and of the County Education Committee.

Professor Somerville stated that in England and Wales there are about 14,000,000 acres of permanent grass land, excluding hill grazings, an area greater than that under arable cultivation. While some of this permanent grass is of excellent quality, and not susceptible of much improvement, there is a considerably larger proportion which is doing but little either for the individual or for the nation. One can meet with poor pastures and meadows in all parts of the country, although they are, perhaps, commonest on heavy land and on the chalk formation.

While a certain amount has been done to improve these poor pastures, it is unfortunately true that many farmers regard them with indifference. Yet most of this land is so easily and profitably improved that farmers who are fortunate enough to own or rent it have ready to their hand an opportunity for such an investment of capital as a man of business would envy. The return which much of such land gives to judicious expenditure is usually far greater than in the case of arable land. Assuming that a man has a field of wheat on which the use of £2 worth of artificial manure sends up the yield from 3 qr. to 4 qr. per acre, he would be well satisfied with the result. It would mean an increase of yield of 33 per cent., and a net profit of about £2 per acre. Now the kind of manure that is used to stimulate the growth of wheat leaves but a scanty residue, so that little remains to help the next crop, but in the case of much poor grass land the most suitable form of treatment would continue its action during several years, and in the aggregate would, in many cases, give a return of several hundreds per cent. Dr. Somerville spoke of many cases where, before treatment, grass land has carried during summer two store sheep per acre, and these during the season have increased about 20 lb. each in live weight, or an aggregate increase of 40 lb. per acre. As the result of treatment the land has carried not two, but four sheep per acre, and instead

of each animal increasing 20 lb. it has gained 40 lb., so that the aggregate gain per acre has been 160 lb.—a four-fold increase. The profits, too, are on much the same scale. Without taking extreme cases, it may be said that it would only be a moderate result if for an expenditure of £1 one got no more than £5 worth of return, spread over, perhaps, as many years.

Professor Somerville has been experimenting on the improvement of grass land for nearly 30 years, and during that period he has farmed many hundreds of acres, most of it under poor grass. He has never failed to find that grass land is at once responsive to improved treatment, and that no class of farming gives such a liberal and certain return on capital expended.

The improvement of grass land is so simple that those who have studied the question are surprised that there is any poor land left to improve. In the great majority of cases all that is required is a liberal dressing with phosphates. Basic slag is to be preferred, not only because it is the cheapest form of phosphate, but also because it is the most effective. Superphosphate acts nearly as well, but is more costly. Other forms of phosphate which may be used, if those already referred to cannot be obtained, are precipitated phosphate and mineral phosphate ground to a very fine powder. It is important that a liberal dressing should be applied in the first instance, at least half a ton per acre of basic slag containing 25–30 per cent. of phosphate of lime. The result is that clover plants, which before treatment were so small as scarcely to be seen, grow with such vigour that in a year or two one would think that there was little else than clover in the pastures. The feeding value of the clover thus stimulated is so high that cases are known of sheep on improved pasture without cake actually putting on more weight than similar animals grazing adjoining unimproved land and daily consuming the greater part of 1 lb. of cake per head.

The improvement, therefore, depends on the presence of clover plants or other *Leguminosæ*. Of all these plants wild white clover is the best, because on account of its creeping habit it rapidly fills up a pasture when it is supplied with phosphates. In the great majority of cases the plants are present and only need stimulating. If they are not naturally present they must be introduced by sowing some seed of the genuine wild variety. The demand for such seed is very keen, and the price has now risen to over 30s. per lb., so that, if it has to be purchased, about 1 lb. per acre must suffice. Farmers, however, can quite easily grow their own supplies. All they have

to do is to stimulate the wild white clover on an acre or two of pasture by a liberal dressing of phosphates, and then cut the crop when dead ripe. It is subsequently threshed and roughly dressed, and with cheap home-grown supplies 5 or 6 lb. of seed per acre may be used. Dr. Somerville has had remarkable success in renovating pastures in this way.

In the great majority of cases phosphates alone are necessary for the treatment of pastures, as contrasted with meadows. In a few isolated cases the addition of 3 to 4 cwt. per acre of kainit, or some other form of potash, may be profitable. Lime used concurrently with the phosphate will generally add something to the yield, but it is seldom that the increase will be profitable. Nitrogen should not be used on a pasture in any form. It will stimulate the grass and weeds at the expense of the clover, with the result that the plant, which above all others should be encouraged, is in danger of being crowded out.

It is surprising how long the effects of phosphates are maintained. In the majority of cases they are plainly visible for ten years, but in about five years from the first application a dressing of about half the original dose should be given, and the response in many cases will be almost as good as to the first treatment.

The clovers, stimulated to luxuriant growth by the phosphates, gather large quantities of nitrogen from the air and store it in their tissues. This nitrogen, secured at no expense, will make its presence felt should such land be put under the plough. Experiments with cereals on land which has been slagged when under grass, and subsequently broken up have shown that the corn grown on such land was 20 per cent. better than crops grown on broken-up turf that had not been slagged. If, therefore, it is decided to plough up grass land, it should be put through a course of phosphatic manuring while still in grass. The improvement of grass and the policy of the plough are not incompatible.

IN connection with the Ministry's scheme for the improvement of grass land, referred to in the above note, the Ministry have recently issued two pamphlets for the information and guidance of those interested in the subject.

**Publications on the
Improvement of
Grass Land.**

The first publication (Miscellaneous Publication No. 24) deals with the general question of grass land improvement. It is a pamphlet of 50 pages, and is

written in a simple and not too technical style, so as to be easily understood by the average reader. The various types of grass land, permanent grass, worn-out grass, and temporary leys, are dealt with, and the possibilities of improvement considered under such headings as manuring, mechanical treatment, renovating mixtures, altered methods of stocking, substituting pasture for meadow conditions or the reverse, and eradication of weeds. Notes on the grasses and clovers used in pasture, the purchase of seeds, and the types of seed mixtures, are also given, as well as information on the conversion of heavy clay land to grass, lucerne and sainfoin leys, and on the treatment of new pastures. Suggestions for increasing the produce of grass land, based largely on experiments made in different parts of the country and on the investigations of Professor Stapledon of the University College of Wales, Aberystwyth, are offered throughout the pamphlet, although to obtain the best results the farmer must understand the different requirements of grass land according to soil, climate, stocking, utilisation, etc.

The second pamphlet (Miscellaneous Publication No. 25) is entitled "The Improvement of Grass Land: Suggestions for Demonstrations and Experiments," and its title explains the purpose it is intended to serve. It may be regarded as supplementary to Miscellaneous Publication No. 24, and the suggestions it contains should be considered in the light of the information given in that publication. It was felt in planning the grass land improvement scheme that an important factor in its success would be the establishment in various parts of the country of suitable demonstration plots. With this view, the scheme of demonstrations and experiments outlined in the pamphlet has been drawn up for the consideration of all interested in the subject. While in no sense exhaustive, the scheme is believed to cover many questions of pressing practical importance. The trials are essentially demonstrations of facts that have been proved generally, rather than experiments for the purpose of acquiring new knowledge or of testing disputed opinions. The pamphlet is divided into two parts. Part I. comprises schemes simple in character and direct and practical in their object, so that they may be capable of general adoption by farmers. Part II. deals with experiments requiring considerable attention and supervision, which are applicable chiefly to college farms or farms in close touch with the Educational Staff of the county.

All farmers who are interested in the subject of grass land improvement are advised to study these pamphlets. They

may be obtained from the Office of the Ministry (Publications Branch), 3, St. James's Square, London, S.W. 1. The price of Miscellaneous Publication No. 24 is 3*d.*, post free, and Miscellaneous Publication No. 25 may be obtained gratis and post free.

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ALTHOUGH the condition of our orchard and fruit plantations to-day shows a marked improvement over that of a few years ago, it still leaves much to be desired. If **Weak and Diseased Fruit Tree Stocks.** fruit growers generally are to be congratulated upon the manner in which they have made use of the results of scientific and technical investigation carried out in their interests, there are too many who are content to remain behind the times, and who do not realise the importance of care and foresight in the business of fruit growing. For example, in buying fruit trees to start a new plantation it can only be false economy to purchase inferior stocks. A plantation is put down to bear fruit for many years, and compared with the value of the crop, year by year, the difference in the initial cost of good and bad stocks becomes quite a trifling matter. Yet one frequently hears of fruit growers taking considerable trouble to obtain cheap supplies.

While this state of affairs exists it is not surprising that nurserymen continue to find buyers for the inferior stock which would normally be relegated to the rubbish heap. Examination of recently-established plantations sometimes reveals apple trees affected with canker, brown rot, crown gall and American blight, plum trees affected with silver leaf, black currants with big bud, peaches with leaf curl, and so on. Even where trees are not affected with disease they are often constitutionally weak and of poor or stunted growth, and, occasionally, altogether devoid of a proper root system.

Under these conditions, it is not surprising that obnoxious fruit pests abound throughout the country, and that large quantities of inferior fruit are on the market.

At the present time conditions are not normal. Stocks are low and there is also a shortage of labour. There is some reason for confidence that both quantity and quality will improve before long in many nurseries at present below their pre-war standard, but the need for these improvements must be pressed vigorously and continuously. It is encouraging to see that the more progressive growers are awakening to the necessity of procuring only the best stocks. Having obtained

them, they are doing their best, by a reasonable and regular system of winter washing, grease banding, spraying, pruning and rubbish destruction, to keep their orchards clean and free from pests. What is needed in the interests of fruit growing is that the methods and practice of the best and most far-sighted growers should be better known and more generally imitated.

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CERTAIN statements recently published in the Press disclose considerable misunderstanding with regard to the object and

**The Ministry and
the River Ouse
Drainage Scheme.**

effect of an Order made recently by the Ministry for the purpose of establishing a single drainage authority to control the whole of the main channels and banks

of the River Ouse and its tributaries.

It has been alleged that if the Order becomes effective the Ouse Drainage Board will embark forthwith on a scheme for putting the river into order at a cost of not less than £3,000,000. Such a statement is, of course, entirely misleading and incorrect. In the first place, the highest estimate yet put forward as the possible total cost of putting the whole river into proper order (and this was a figure put forward by the opponents of the Order at the public inquiry) was not £3,000,000 but £2,000,000.* In the second place, even assuming that such a figure represented the probable cost of putting the rivers into order, it is obvious that the work would necessarily be extended over a great number of years, and that at nothing approaching such a sum would ever be raised at once. The Ouse Drainage Board, when established, will be a body elected by the ratepayers of the district, and it is inconceivable that a body of that nature would embark upon any such fantastic career of extravagance as is suggested by the persons who have made the statements referred to above.

Calculations have also been put forward, and results have been published in letters to the Press, of the amount of the rate per acre which may be expected to be imposed on agricultural land in the upper valley of the Ouse by the Ouse Drainage Board. Those calculations were not only made on false assumption that the Drainage Board will raise a sum of £3,000,000 by a single loan, but they appear to have been based on the original draft of the Ouse Drainage Order. The rating schedule contained in that draft was revised drastically in favour of the upper parts of the valley before the Order was sealed by the

* The Ministry has recently been informed that the figure £3,000,000, which appeared in a letter to *The Times*, was a mistake, and that the writer of the letter intended to write £2,000,000.



FIG. 1.--Before cleaning, 1918.

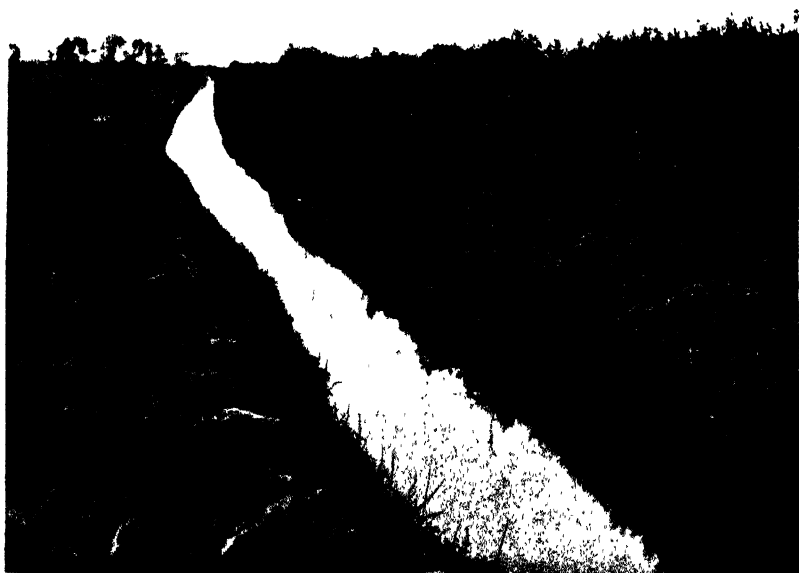


FIG. 1a.—After cleaning, 1919.

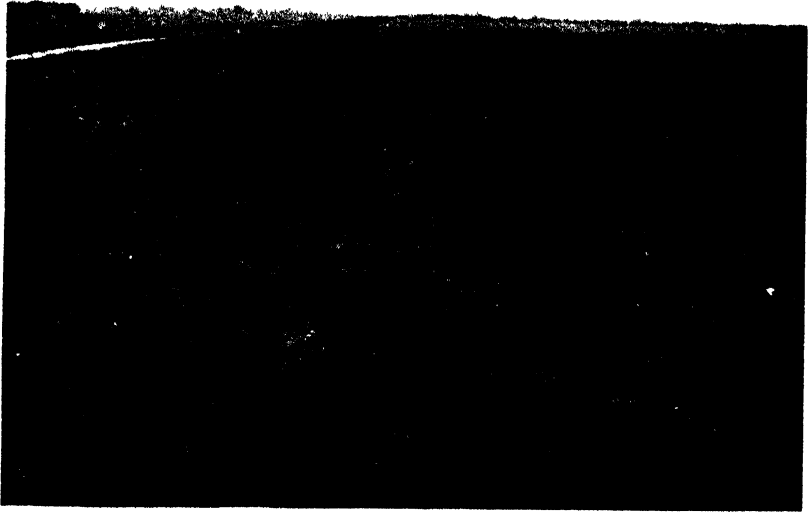


FIG. 2.—Before cleaning, 1918.

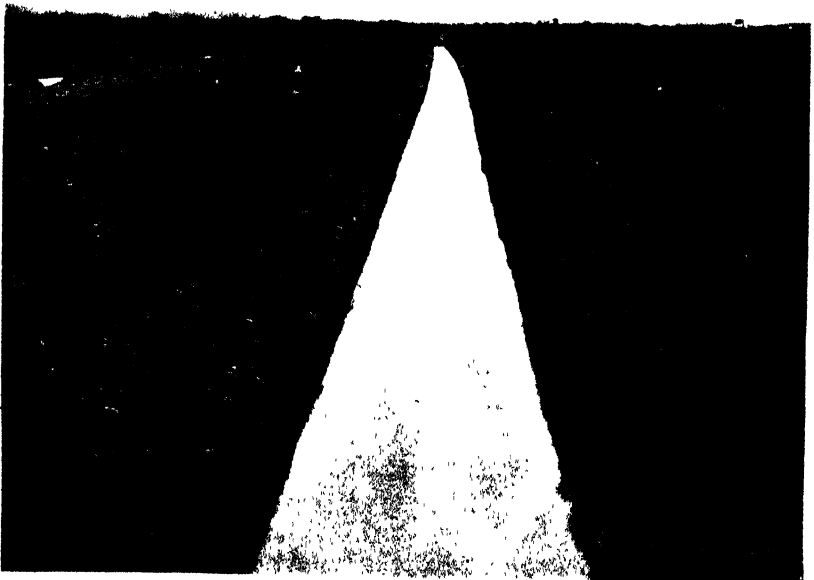


FIG. 2a.—After cleaning, 1919.

Ministry of Agriculture, and hence any calculations made upon the basis of the original draft are of no value.

The Order has further been criticised on the ground that it does not include in the rateable area of the Ouse Drainage Board any lands situated at a greater height than 8 ft. above the highest recorded flood level. It is considered by many that the whole of the lands from which water finds its way into a river should, in justice, be rated for the maintenance of that river. This view has been urged repeatedly before both Houses of Parliament, and the subject has been fully considered by a Committee of the House of Lords. The result, however, is that the general law relating to land drainage remains as it has always been since the year 1531, and the fundamental principle of that law is that no land can be rated for the maintenance of a river unless it derives some degree of benefit from such maintenance. The best modern agricultural opinion is that such benefit cannot be said to extend to land lying at any greater height than (approximately) 8 ft. above flood level, and for that reason no land outside the "8-ft. line" is included within the boundaries of new Drainage Districts.

Generally, it is important that all who are interested in the question of the drainage of the Ouse valley should bear in mind that the new Drainage Board will be entirely free to shape its own policy. At the same time it will be subject to the restrictions which are imposed by the general law and by the Ouse Drainage Order itself, as to expenditure on new works and the improvement of existing works. Finally, it will be an elective body, and will, as such, carry out the wishes of the ratepayers by whom it will be appointed.

* * * * *

THE four photographs reproduced, taken in 1918-19, show two sections of the work carried out by the Anglesey Agricultural Executive Committee under the powers of the Defence of the Realm Regulations for the drainage of Malldraeth Marsh.

Land Drainage in Anglesey.

Before the work was taken in hand by the Committee, practically all the drains in the Marsh were in the condition shown in the two earlier photographs. The total length of drains and ditches cleaned out by the Committee in the way illustrated cannot be given exactly, but it is estimated that at least 4,000 acres of land in the Marsh have received substantial benefit. The total cost of the work amounted to approximately £2,400.

This is only one of a large number of similar undertakings which have been carried out by Executive Committees in low-lying lands throughout England and Wales during the past two years.

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THE Report on the Lincoln Tractor Trials was issued by the Society of Motor Manufacturers and Traders a few weeks ago,

**The Lincoln
Tractor Trials.**

but it does not seem necessary to add very much to the preliminary notice which appeared in this *Journal* in October last, while the data afforded do not suggest any modification of the conclusions then expressed. A summary of the results printed in the Technical Advisor's Report has already appeared widely in the agricultural press, and no object could be served by reproducing them. The most serious omission is any statement of the actual work accomplished by the tractors: the figure for the "estimated acres per day of eight hours" is of very little value, and without the data upon which it is based may be positively misleading. Although it might be suggested that it would be a little unfair to take the number of acres ploughed and the time taken by stoppages during a trial of a few days' duration as the basis for a calculation of the amount of work to be expected during the whole life of the machine, yet there is no escape from this method if all the other figures are based, as they are based, upon the recorded performances during the trial. It may be assumed, although it is not directly stated, that the estimated acreage per eight hours is deduced from the actual performance plus an allowance for time recorded as lost either on the tractor or the plough. If this be so, the actual performance may be calculated with a little trouble.

The Technical Advisor's Report takes up the major portion of the volume and rather overshadows the Judge's Report. The standpoint from which the Judges regarded the trial is sometimes a little obscure. As regards the first tractor on the list, they express the opinion that "the weight of this tractor, 3 tons, is excessive for work on the land, especially on heavy land in wet weather," and this note runs through a number of their criticisms. In their general remarks, for instance, they state that "the use of caterpillar tracks undoubtedly reduces the pressure per square inch on the land, and where well designed may permit of ploughing under conditions where a wheeled tractor could not be used." It may be asked, however, whether there is any advantage in seeking

to plough under "unfavourable" or "adverse" weather conditions, as the Judges express it in various places. In the past the farmer has had frequently to work when he would, if he could have chosen, have deferred doing so until soil conditions were suitable, and it may be suggested that the one great contribution that the tractor will make to farming will be to enable the farmer to take advantage of the "favourable" weather. The proposal that has already been made that implements should be adapted or remodelled to meet the increased speed which may be expected from tractors in the future has much bearing upon this point.

In their comments upon the ploughs used, the Judges several times refer to ploughs being driven too fast. Does not this really mean that the plough will turn a suitable furrow at a certain speed, but that above this speed some defect discloses itself? This is exactly the information that is required, and the hope may be expressed that any future report will contain a statement of the critical speed and the precise defects which develop beyond this point, and, if possible, the reasons. With such knowledge progress in the design of tractor ploughs—and, indeed, of all other tractor implements—would be accelerated.

In conclusion, it is proper to say that the Report is admirably produced, and that whatever deficiencies there may be, these are not numerous for a new venture. Upon the basis of the first Report it will be a comparatively easy task to produce, after future trials, Reports giving complete data relating to both tractors and implements, having regard throughout to the limited period covered by trials of this nature.

AN arrangement has been reached whereby the Society of Motor Manufacturers and Traders, Ltd., will join the Royal Agricultural Society in carrying out tractor trials in the autumn of the present year.

**Tractor Trials
in 1920.**

At first it was feared that there would be two separate trials, which would have entailed inevitably much waste of time, money and work. The value of the trials to those who are using or propose to use tractors will undoubtedly be enhanced by the union of two such powerful bodies as the R.A.S.E. and the S.M.M. & T. One of the chief benefits of this united exhibition will be that the farmer will have an opportunity of seeing every machine at work and making comparisons on the spot between the various performances. It was found when the two Societies met to discuss united

trials that there was only one question outstanding between them and that was the question of making the trials competitive. The one united show is certainly likely to be more representative than either of the two proposed independent trials could have been. The result of the deliberations of the Joint Committee now appointed by the two bodies will be awaited with interest. The report of the Lincoln Trials shows clearly that a very substantial advantage rests with the principle adopted by the S.M.M. & T. of stating the actual performance of each machine, although, even there, the competitive element cannot be said to have been entirely eliminated.

In choosing seed for silage crops or summer fodder preference is usually given to tares or other legumes, because they produce

**The Best Seeds
for Silage and
Summer Soiling.**

a forage containing a high proportion of albuminoids. In the case of tares or peas the stems are so weak that they cannot support their own weight, and some other plant becomes necessary to provide the support required; if this is not given the crop lies on the ground, is liable to rot at the base, and becomes very difficult to cut. The inclusion of a small proportion of beans will help to mitigate this defect. The addition of oats to the mixture is also an advantage, as the oats serve not only to support the weaker legumes but also to provide a suitably-balanced fodder.

Both tares and peas are relatively scarce at the present time, tares being the more expensive. Peas, therefore, may be used to replace tares in whole or in part.

A suitable mixture for spring sowing would be :—

2 bush. oats	} per acre.
1 „ field peas or vetches	
$\frac{1}{2}$ „ beans	

Forage mixtures such as the above may be used with advantage for silage, for soiling, or for making into hay; they may also partly replace roots on the heaviest classes of soils. (If intended for hay, beans should be omitted.)

A moderate dressing of farmyard manure, where available, will give good results in most circumstances; so also will the following mixture of artificials :—

$\frac{1}{2}$ cwt. sulphate of ammonia	} per acre.
2 „ superphosphate	
$\frac{1}{2}$ „ sulphate of potash	

ATTENTION is called by the Michigan Agricultural College in their latest quarterly Bulletin for November, 1919, value to the of forage crops for pigs. Experiments in that State have proved that from one-quarter to one-half less grain is required to produce a given amount of pork on forage crops than is needed under conditions where these are not available.

Forage Crops for Pigs: The Value of Rape.

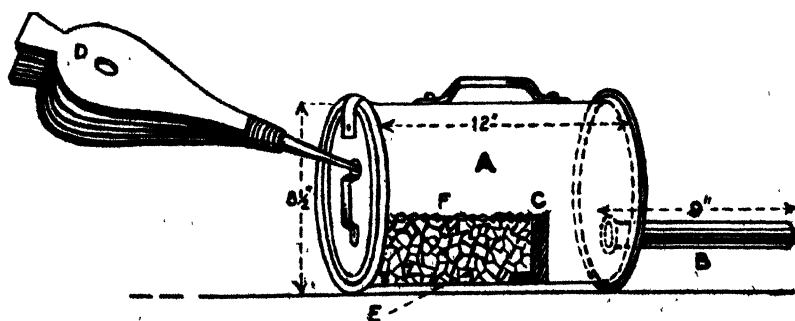
The crops recommended are a mixture of oats and peas, and also rape. Rape seems the best crop for the purpose in Michigan, and pigs make rapid growth on it when it is supplemented by a medium grain ration. It is usually sown broadcast for the purpose at the rate of 5 lb. per acre (Dwarf Essex being the variety recommended) between early spring and June; on light, sandy soils it may be advisable to sow in drills, using 3 to 3½ lb. seed per acre.

Pigs would then be turned on the rape when it is about 8-10 in. high; this is usually about six weeks after sowing. With frequent rain, and if the rape is kept fairly well down, new shoots will develop. A plan recommended is to sow at least two plots and change the pigs over from one to the other, thereby giving the new shoots a chance to develop.

* * * * *

RAT poisons such as squills and barium carbonate can be used with good effect and without risk to other animals or live stock, if applied with all due care, but many poultry farmers, pig keepers and stock owners are reluctant to use any form of poison to destroy rats under poultry runs, pig-styes, etc.

A Simple Apparatus for "Gassing" Rats.



The simple apparatus here illustrated can often be used to fumigate the rat runs in banks and hedgerows, and under

fowl houses and styes, and has the additional advantage of cheapness, being easily made from old material. In order to make the apparatus the procedure is as follows: Take an old paint drum (A) of about 12 in. in length and $8\frac{1}{2}$ in. in diameter, fasten the lid to the side with a link hinge, and punch a hole in the lid to admit the point of a pair of small bellows (d). In the base of the drum punch a hole 2 in. in diameter and in this hole fix a piece of metal piping (B) 9 in. in length. A strip of metal $2\frac{1}{2}$ in. high should be rivetted on the inside of the drum at (c) to prevent the cotton waste (e) and small sulphur (f) choking the orifice of B. To facilitate carrying a small handle can be fixed to the side of the drum as shown.

When the apparatus is to be used the lid should be opened and some old oily cotton waste placed within and ignited. If necessary, the lid should be closed and the cotton waste fanned with the bellows to a good glow (if the lid is left wholly or partly open, free contact with the air will often be sufficient to cause the cotton waste to glow). With a view to finding out connecting runs in a burrow, in banks and hedgerows, as soon as smoke issues from spout B of the apparatus the spout should be placed in a hole, if possible to the windward of other holes. All holes from which smoke issues, except one of the lower ones and the highest, should then be plugged lightly. The drum should then be opened and a layer of sulphur (f) be sprinkled on the glowing cotton waste. The spout (B) should then be inserted into the lower hole and the bellows (d) be used. In a few minutes colourless sulphur dioxide will be generated, and in about a quarter of an hour or longer, according to the size of the burrow, the rats will either succumb to the gas or try to bolt—in the latter case to be easily dispatched by sticks and dogs. This gassing has the advantage of killing both large and small rats at a minimum cost, and the fumigated burrows, if not immediately destroyed, will not be used again for some time.

Organised Measures for Rat Destruction.—As a consequence of the Rats and Mice (Destruction) Act, 1919, which came into force on the 1st January, the Ministry of Food have revoked as from the 7th March the Rats Order, 1918-19. Local Authorities have no longer, therefore, the power to pay rewards out of public funds for the killing of rats. What was previously encouraged by way of reward is now imposed



"Bag of Rats" (275) obtained in three days during threshing at a farm in Herefordshire. In this county Rat Destruction is being carried out on original self-supporting lines, under the supervision of a Rat Officer.

upon the owner or occupier of premises as a legal obligation. Great commercial companies are recognising their duty. The London and North-Western Railway Company, for example, have appointed an Officer to supervise rat destruction over their whole system, and a committee consisting of members of the various branches of the service has been formed to co-operate with him. The Ministry have addressed a letter to all Railway Companies informing them of the action of the London and North-Western Railway Company and suggesting that they should follow this example. The County and Urban Authorities have also been very active. Since the passing of the Act many counties and boroughs have appointed officers to administer the Act. In Leeds a Rats Officer has been appointed to conduct a special campaign. The Swansea Port Sanitary Authorities have appointed their Chief Inspector as an Executive Rat Officer, and in several counties authorities are beginning to receive the thanks of farmers, who now realise that the steps taken to destroy vermin are likely to have most satisfactory results. The work done in England is attracting considerable attention in the Overseas Dominions and elsewhere.

The Third National Rat Week.—The Third and last National Rat Week of the season was carried out between 23rd February and 1st March. The evidence which has been collected as a result of these national measures for rat destruction shows quite clearly that the Rat Weeks have served to reduce the enemy by many millions, and that the saving to the country must amount to very many times the expense involved. Very much, of course, yet remains to be done. On one farm in Herefordshire a short while ago 275 rats were killed during threshing operations, while in Monmouthshire, during the threshing of four wheat stacks on a farm, the Rats Officer and his assistant destroyed upwards of 1,000 rats.

A significant result of the National Weeks can be gathered from letters received by Local Authorities, which show that in districts round large manufacturing centres that have been properly treated there has been a great diminution in the number of rats seen.

Establishment of Research Laboratory.—The Treasury have sanctioned the establishment of a research laboratory, in which research work and investigation with a view to improving in methods of rat destruction will be carried out.

It is believed that a number of the many pig insurance clubs in the country are not being run at present on sound financial lines. Recent investigation has shown

Pig Insurance. that some of them have good balances in hand, but these balances are apt to mislead. If any of the clubs were to suffer losses they would probably be crippled very quickly owing to the large amounts they would have to pay out to their members. The present price of pigs is high, and compensation would need to be very large in order to be effective. The only way of meeting the difficulty is to make the subscriptions of members bear a proper relation to the risks, and those responsible for the direction of the pig clubs would be well advised to assure themselves that this is the case in their own club.

When insurance clubs were first started, members were asked to pay sums varying from 6*d.* to 1*s.* a quarter for each pig insured. Anyone who will consider the position that would arise in a club of 40 to 50 members if heavy and unexpected losses took place will see that subscriptions of 4*s.* a year or less per pig must needs prove quite inadequate to the requirements of the case. It is, therefore, suggested that pig insurance clubs should raise their subscriptions without delay in order to meet the altered conditions. The Small Livestock Branch of the Ministry has dealt with this question for several societies, and is prepared to give advice and assistance to any that may desire to avail themselves of it.

A CONFERENCE of bee-keepers was held in February at the Surveyors' Institute, Westminster, London, S.W., 1, to discuss the question of legislation to check Isle

The Government and the Bee-Keepers. of Wight and other bee diseases. Bee-keeping Associations and Agricultural Education Committees were represented, and invitations were also sent to a number of experienced bee-keepers, particularly to those who were known to be in opposition to the proposals for legislative action. There was considerable preliminary discussion, which showed that differences of opinion among experts in bee-keeping existed, but a resolution urging the introduction of legislation was passed almost unanimously. Details of the Bill it is hoped to put before Parliament during the present session were discussed, and finally the meeting decided unanimously in favour of the compulsory registration of all bee-keepers. The discussion revealed the fact that while

there are not nearly enough hives in the country the number of careless bee-keepers is far too many, and that these people are largely responsible for the spread of disease. That there is great room for improvement in the existing conditions is best shown by a statement made at the Conference that of every 4 lb. of honey eaten in this country 3 lb. are imported.

THE attention of farmers, small holders and others is called to the extensively advertised sales of surplus Government Stocks of Nissen huts. The dimensions
Nissen Huts. are: length, 27 ft 6 in.; width, 16 ft.; height, 8 ft. The huts consist of semi-circular sections in black corrugated iron, steel and wood, complete with all necessary fittings and ready for immediate erection.

Each hut forms a permanent building, absolutely weather-proof and of great durability, suitable for housing, storage or workshop, or for accommodation for calves, or shelter for pigs or sheep.

Prices range from £25 each for single huts, or £20 each for a quantity at Government depots at Slough and Woolwich, and inquiries should be addressed to the Controller, Government Surplus Property Disposal Board, Artillery Mansions, Victoria Street, London, S.W. 1.

THERE has been an appreciable fall in prices of feeding stuffs, especially cakes, since last month, due no doubt to the fact that there are more than average stocks

**Notes on Feeding
Stuff for April:**

*From the
Animal Nutrition
Institute, Cambridge
University.*

in the country. Refined oils have increased in price, and this may have enabled the cake crushers to take less for their cake. The fall in price has not been uniform, however, as is shown by the following table, which gives prices per ton and per food unit of a number of common feeding stuffs. The prices are approximately those realised at London wharf or store. Local prices will in most cases be rather higher on account of freight and commission.

TABLE I.

	No. of Food Units per Ton.	Price per Ton.	Price per Food Unit.
		£ s.	s. d.
Palm kernel cake	96	12 0	2 6
Wheat middlings—coarse	90	12 10	2 9
Ground nut cake—semi-decorticated	110	16 10	3 0
Coconut cake (home-made)	103	16 0	3 1
Wheat bran	78	12 10	3 3
Decorticated cotton seed meal	126	22 10	3 7
„ „ cake, American	126	23 0	3 8
Brewer's grains, dried	85	16 5	3 10
Soya bean cake	122	24 0	4 0
Linseed cake, Indian	123	24 15	4 0
„ „ English	123	24 10	4 0
Chinese beans	101	20 10	4 1
Cotton cake, English made	72	16 0	4 5
„ „ Egyptian	72	16 5	4 6
„ „ Bombay	65	15 0	4 7
English beans	100	23 15	4 9
Maize meal	86	20 10	4 9
„ American	94	23 0	4 11
English oats	75	21 10	5 9

The table shows the very great variations in the value of different feeding stuffs at present prices. Thus, English Oats cost considerably more than twice as much per food unit as palm kernel cake or wheat middlings. Reference to Table II., giving the composition of common feeding stuffs, shows that among the first five feeding stuffs in Table I., all of which under present conditions must be considered cheap, there is very great variety in composition.

Palm kernel cake contains 14 per cent. of digestible protein and 6 per cent. of digestible oil. It is not so rich in these

TABLE II.
FEEDING VALUE OF COMMON FEEDING STUFFS.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Name of Feeding Stuff.	Nutritive Ratio.	Per cent. digestible.			Digestible Food Units per ton.	Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
		Protein.	Fat.	Carbo- hydrates and Fibre.			
<i>Foods Rich in both Protein and Oil or Fat.</i>							
Ground nut cake ..	1: 0.8	45.2	6.3	21.1	145	78	102
Soya bean cake ..	1: 1.1	34.0	6.5	21.0	122	67	88
Decort. cotton cake ..	1: 1.2	34.0	8.5	20.0	126	71	93
Linseed cake, Indian ..	1: 1.9	27.8	9.3	30.1	123	77	101
Linseed cake, English ..	1: 2.0	26.7	9.3	30.1	120	76	100
Cotton cake, Egyptian ..	1: 2.1	25.5	5.3	20.0	72	40	53
Cotton cake, Bombay ..	1: 2.5	13.1	4.4	21.5	65	38	49
Distillers' grains ..	1: 2.9	18.7	10.2	29.0	101	57	75
Maize gluten feed ..	1: 3.0	20.4	8.8	48.4	122	87	115
Brewers' grains, dried ..	1: 3.5	14.1	6.6	32.7	85	50	66
Coconut cake ..	1: 3.8	16.3	8.2	41.4	103	77	101
Palm kernel cake ..	1: 4.5	14.1	6.1	48.9	96	77	101
Linseed ..	1: 5.9	18.1	34.7	20.1	154	119	157
Bombay cotton seed ..	1: 6.6	11.0	16.8	30.1	100	78	102
<i>Fairly Rich in Protein, Rich in Oil.</i>							
Maize germ meal ..	1: 8.5	9.0	6.2	61.2	99	81	107
Rice meal ..	1: 9.4	6.8	10.2	38.2	79	68	90
<i>Rich in Protein, Poor in Oil.</i>							
Fish meal ..	1: 0.1	54.0	2.0	—	125	56	74
Peas, Calcutta white ..	1: 2.1	23.3	1.1	45.9	97	70	88
Beans, English ..	1: 2.6	19.3	1.2	48.2	100	67	88
Beans, Chinese ..	1: 2.6	19.6	1.7	47.9	101	67	88
Peas, English maple ..	1: 3.1	17.0	1.0	50.0	97	70	92
Palm-nut meal (ex- tracted) ..	1: 3.4	15.6	1.9	48.7	92	66	87
Brewers' grains, wet ..	1: 3.5	3.5	1.5	8.6	21	13	17
Malt culms ..	1: 3.6	11.4	1.1	38.6	70	39	51
<i>Cereals, Rich in Starch, not Rich in Protein or Oil.</i>							
Barley, feeding ..	1: 8.0	8.0	2.1	57.8	83	68	89
Oats, English ..	1: 8.0	7.2	4.0	47.4	75	60	79
Oats, Argentine ..	1: 8.0	7.2	4.0	47.4	75	60	79
Maize, American ..	1: 11.5	6.7	4.5	65.8	94	81	107
Maize, Argentine ..	1: 11.3	6.8	4.5	65.8	94	84	110
Maize meal ..	1: 13.0	5.5	3.5	63.9	86	79	102
Wheat middlings ..	1: 4.8	12.8	4.1	52.5	95	73	96
Wheat sharps ..	1: 5.1	11.6	3.4	51.6	90	62	80
Wheat pollards ..	1: 4.5	13.6	3.7	52.5	97	62	82
Wheat bran ..	1: 4.7	11.3	3.0	45.0	78	50	65
Wheat bran, broad ..	1: 4.7	11.3	3.0	45.4	80	48	63
Locust bean meal ..	1: 22.1	4.0	0.7	69.2	80	71	94

valuable constituents as some other cakes: nevertheless, it is a very useful feeding stuff, and is especially suitable as part of the ration of milch cows. It has also been used with success for fattening cattle and sheep, and in experiments on the Cambridge University Farm has given excellent results with pigs. At its present low price it should be widely used for all kinds of stock. Its only drawback is that stock do not take to it at first very readily.

Wheat middlings, the second cheapest food on the list, is almost too well known to need comment. It is far the cheapest feeding stuff rich in carbohydrates at the present time. It is a noteworthy fact that foods rich in carbohydrates have been scarce and dear ever since the early stages of the War, no doubt because of the short supply of wheat which in 1917 and 1918 caused other cereals to be used for milling, and still influence the cereal market generally. Middlings will, no doubt, be largely used for pig feeding, but at its present price it would be found a most useful and economical addition to the diet of fattening cattle to replace roots, which are likely to be running short by now in many districts. In the later stages of fattening, cattle require plenty of carbohydrate in their diet. Normally, this is provided by the sugar in the roots. If roots are scarce it is better to replace them by middlings than by cake. For this purpose 1 lb. of middlings would take the place of 10 lb. of roots, or, say, 4 lb. would replace about a bushel.

At present prices it would also be economical to replace part of the oat ration of farm horses by middlings or bran. For this purpose 1 lb. of oats should be replaced by rather less than 1 lb. of middlings or by 1½ lb. of bran. Replacement should take place in proportion to the starch equivalent.

The third cheapest food in Table I. is semi-decorticated ground nut cake. Since this feeding stuff was noticed on the market last month samples have been obtained and analysed, with the following results, which are shown side by side with the analyses of decorticated and undecorticated ground nut cakes.

	<i>Decorticated.</i>	<i>Semi-</i>	<i>Un-</i>
	<i>Per cent.</i>	<i>decorticated.</i>	<i>decorticated.</i>
		<i>Per cent.</i>	<i>Per cent.</i>
Water	10.3	9.8	10.3
Protein	46.8	34.2	30.2
Oil	7.5	9.3	9.1
Carbohydrate ..	23.2	21.6	21.8
Fibre	6.4	17.4	22.9
Ash	5.8	7.7	5.7
	100.0	100.0	100.0

Semi-decorticated ground nut cake is shown to be intermediate in composition between decorticated and undecorticated cake, but approximates much more nearly to the latter than to the former. The process of decortication consists in removing the husk from the seed before crushing. From the high percentage of fibre in the cake described as semi-decorticated it is evident that the decortivating process has not

proceeded very far. Indeed it seems hardly justifiable to use the name even when qualified by the prefix "semi." It has not been possible to make a determination of the digestibility, but it is no doubt very near to that of the undecorticated cake. On this assumption the number of food units per ton is probably about 110. The writer has used a sample of this semi-decorticated cake as an addition to roots and straw for fattening cattle since November last with good results. The cattle have thrived and made good increases. It is a cake with a high percentage of protein, and should not be given in large quantities or the protein in the ration will be unnecessarily high.

Coconut cake is the fourth cheapest feeding stuff on the list, its price per ton corresponding to 3s. 1d. per food unit. Its composition is similar to that of palm kernel cake, and it can be used generally in the same way as that cake.

Wheat bran, the fifth food in order of price per food unit, is so well known and so widely used that no comment on it is required.

A correspondent has kindly suggested that some account should be given in this month's notes of sesame cake. He adds that he bought a quantity of this cake some time ago and found it satisfactory for cattle and sheep. Its keeping qualities were good. A quantity kept for a year did not show rancidity. Sesame cake is obtained by expressing the oil from species of *sesamum* grown in India and Asia Minor. As made in England its composition is:—

						<i>Digestible</i>
						<i>Nutrients.</i>
						<i>Per cent.</i>
						<i>Per cent.</i>
Water	..	..	..	..	9.3	—
Protein	..	..	..	..	44.5	40.0
Oil	..	..	..	..	11.9	10.7
Carbohydrates	..	..	..	..	20.9	11.7
Fibre	..	..	..	..	4.5	1.4
Ash	..	..	..	..	8.9	—

On the basis of the above figures it contains 130 food units per ton, and its starch equivalent is 73. It has been used largely in France and in Germany. Most of the information about it comes from the latter country, where it is looked upon as a most suitable feeding stuff for dairy cows so long as the daily allowance per cow does not exceed about 3 lb. It is exceedingly rich in protein, and contains much oil. In this it resembles decorticated cotton cake and ground nut cake.

Lime on Land to be sown for Clover.—A common cause of the failure of clover is lack of lime in the soil. Clover will not tolerate acidity, and any deficiency of

Notes on Manures for April: lime soon leads to this undesirable condition. Cases have repeatedly been brought to the notice of the Rothamsted Experimental Station of the failure of clover seeds, which, after careful examination, was traced to the absence of lime in the soil.

In view of the cost of clover seeds, and the desirability of securing good plants, farmers will be well advised, in cases where there is the least doubt, to have their soils examined in regard to the lime content, so that they can give a dressing if necessary. While it is probably too late to use burnt lime, there is still time to apply ground limestone or ground chalk, both of which are effective in neutralising soil acidity and improving the condition of the clover crop.

Damage to clover as the result of applying sulphate of ammonia to the covering corn crop has also been reported. In our experience this happens only when there is a shortage of lime in the soil, and is a further reason for ensuring adequate supplies. It is quite unnecessary to refrain from the use of spring dressings because of the possibility of injuring the clover.

Purchase of Waste Lime.—A correspondent sent a sample of waste lime material which on drying contained 99 per cent. of calcium carbonate and 1 per cent. of impurities, chiefly magnesium carbonate. The sample was not in good condition or it would have been worth as much as good ground limestone. After drying, however, it could be broken up sufficiently finely to be applied to the land.

No general rule can be given as to the proper quantity of these waste materials to apply per acre. Everything turns on the degree of fineness; some of the waste limes are so lumpy, even after rough drying, that they could not be used at a lower rate than 10 to 15 tons per acre.

The application would have to be made in winter in the hope that the frost would cause disintegration and facilitate distribution. With better drying and some degree of grinding the effectiveness of the material might be increased two or three times, and application could then be made later owing to the greater ease of distributing the material in the soil. Commercial firms turning out waste lime would do well to ascertain whether they could dry and grind the material so as to give the farmer

an effective fertiliser which could be easily applied instead of the less valuable waste product.

Comparison between home-mixed and purchased Compound Fertiliser.—In the Notes for December (this *Journal*, November, 1919) reference was made to a compound fertiliser offered at £19 per ton, and a home-made mixture was suggested which would give the same amount of fertilising constituents at a considerably lower price. This has led to correspondence with some of the fertiliser manufacturers, who felt that the composition stated did not fairly meet the case, and one of the manufacturers made the entirely valid point that the mixture proposed in these Notes was based on the salesman's ammonia figures, whereas in a court of law the salesman would probably have been held to his nitrogen figure which was somewhat higher. Working on this basis it would be necessary to add sufficient sulphate of ammonia to increase the nitrogen by 0.7 per cent., which would increase the cost of the home-made mixture by 15s. per ton. Even after allowing for this increase in value, however, the figure of £19 per ton remains unjustifiable on a purely cost basis. We have every desire to be fair to the fertiliser manufacturers, and the sole purpose of the note was to draw attention to the price, which is admittedly in excess of what a first-class manufacturer would charge.

Growth of Swedes where the Supply of Farmyard Manure is limited.—A Lancashire correspondent asks what fertiliser he could use for swedes in the following conditions:—(1) He has not much farmyard manure; and (2) Swedes do so well on one field that he is anxious to grow them there again if he can.

Numerous experiments on the manuring of swedes which have been carried out by Professors Somerville and Gilchrist and others in the north of England have shown that it is unnecessary, as a rule, to use both farmyard manure and artificials for swede crops.

It is well known that good results can be obtained with farmyard manure, but where insufficient is available to allow of suitable dressings, good results can be obtained with 4 to 6 cwt. of superphosphate or basic slag, together with 1 cwt. sulphate of ammonia, at the time of sowing, then 1 cwt. nitrate of soda as a top dressing at the time of singling.

With reference to the question as to whether swedes can be sown on the same land year after year, the chief trouble is in regard to the flea beetle; provided this pest is absent there is no particular difficulty in growing successive crops of swedes.

At one time 15 successive crops were raised on the Barnfield at Rothamsted, and so long as manure was applied the crops did well.

Effect of Ammonia on Wireworms.—Certain observations at the Rothamsted Experimental Station have shown that ammonia (not sulphate of ammonia, but the base itself) is distinctly harmful to wireworms. This substance is produced in soils where liquid manure is applied and where sheep are folded on the land. A correspondent sends us a letter from a manure merchant quoting these facts, and stating that his organic manure is also a cure for wireworms, presumably through the liberation of ammonia. It should be pointed out that there is no evidence that ammonia is liberated from organic manures in sufficient quantity at any one time to injure wireworms, and in no case is the material as unstable as urea, which is present in the excretions of sheep and in liquid manure.

Use of Basic Slag on Grass Land.—The attention of farmers in the eastern counties is directed to the interesting results obtained by Mr. G. Scott Robertson in Essex from the use of basic slag on grass land. As is well known there are several grades of slag, and Mr. Robertson's object was to find out what difference existed between one and another. Broadly speaking, it appears that the high-grade slag is on the whole the best material to use, but it is approached very closely by the lower-grade slags, especially when these are used at a rate to ensure the application of sufficient phosphoric acid per acre. It would be unreasonable, for example, to expect 5 cwt. of a 20 per cent. slag to be as effective as 5 cwt. of a 40 per cent. slag, and yet this is sometimes expected. The proper method is to allow for the percentage of phosphate in the slag in deciding what dressing to give, regarding 10 cwt. of the 20 per cent. slag as the true equivalent of 5 cwt. of the 40 per cent. slag.

Perhaps the most striking feature of the results is the fact that the slag has acted well on the Essex grass land in spite of the prevailing dryness. The rainfall is low, the soils are not wet, and yet the slag has proved effective. This is shown not only by the yields, but to a remarkable extent by the botanical analysis of the herbage. On the unmanured grass land only about one-third of the soil is covered with grass and clover; of the remainder nearly half the surface of the soil is bare, and about a quarter is covered with weeds. On the slagged land, however, practically the whole surface is covered—half of it with clover, the remainder mainly with grass and with only a small proportion of weeds.

A further interesting result is that finely-ground mineral phosphate gives satisfactory results on grass land, and can be used if slag proves unobtainable.

Although it is not usual to apply slag as late as this, farmers will do well to examine their grass land closely during the present season, and ascertain whether they should not apply slag early next autumn.

COMPOUND MANURES.

FOR various reasons farmers frequently have recourse to compound manures supplying in greater or less degree most of or all the food constituents required by plants. In such circumstances the farmer can either purchase the ingredients of the mixture and mix them himself, or he can request a reliable manure merchant to compound a mixture according to his (the farmer's) specification. The farmer knows the manurial requirements of his own land better than the merchant; or if he is not certain on this point he can seek the aid of the agricultural organiser of his county, who is specially qualified to advise and who has a knowledge of local conditions. It is probably more economical for the farmer to do his own mixing, as he can employ his men on this work at slack periods and avoid the charge for mixing made by the merchant.

Manures which may and may not be mixed.—Sulphate of ammonia or other ammoniacal manure must not be mixed with any manure holding free lime, such as basic slag and basic superphosphate, nor should it be mixed with precipitated phosphates or with manures containing much carbonate of lime, such as Belgian and Algerian phosphates. The result of making such a mixture is the liberation of free ammonia, the presence of which, in the air, can be detected by its pungent odour. Sulphate of ammonia may, however, be mixed with superphosphate, bone manures, fish meal, nitrate of soda, salt and most forms of potash. Mixtures of sulphate of ammonia and superphosphate, or both of these along with salt and kainit, if not sown soon after being made, become moist and pasty; this, however, can be obviated by including in the mixture a drying manure such as bone flour, fine bone meal, or castor meal to the extent of at least 1 in 10.

Nitrate of soda should not ordinarily be mixed with superphosphate or dissolved bones; not only may such a mixture

result in the loss of some of the nitrogen, but the mass is apt to become sticky and difficult to sow. The addition of a considerable proportion of drying manures, such as a fine bone meal or steamed bone flour, will remedy this. Nitrate of soda may be mixed with salt or any potash manure without bad result. It may also be mixed with basic slag and raw mineral phosphates, but this mixture should be used at once and not stored.

Nitrolim may be mixed with basic slag, bones, or with any potash manure; and it may also be mixed with good, dry samples of superphosphate, although in this case a little heat may be developed and part of the water-soluble phosphate may be "reverted." Nitrate of lime is not suitable for making mixtures.

Superphosphate should not ordinarily be mixed with basic slag, precipitated phosphate, or ground mineral phosphate, as this results in the soluble phosphate of the superphosphate becoming insoluble in pure water (though readily soluble in soil water) to an extent dependent upon the lime present. On the other hand, bone flour and bone meal produce no such effect unless the mixture is allowed to lie for a long time, while they produce a dry, powdery mixture with the acid manure. Nevertheless, slag and superphosphate are frequently mixed for the reason that the mixture sows better than either ingredient alone and because any disadvantages that superphosphate may have on account of its acidity are removed. A better mixture is obtained by using steamed bone flour instead of slag.

How to mix Manures.—In making mixtures the ingredients should be very thoroughly incorporated in small quantities.

Lumpy manures, before mixing, and the mixture when made, should be passed through a sieve and the remaining lumps carefully broken up. If the mixture is not to be sown immediately it should preferably not be bagged at once, owing to its tendency to set immediately after mixing, but should be allowed to lie in a heap for a few days, after which it may be broken up, turned through a riddle or harp, and then bagged. After this treatment the mixture will not readily set or become lumpy, and may be kept for weeks. The most important point is always to mix systematically in small quantities.

General Mixtures.—Examples of general mixtures adapted for average conditions are given below for the different farm crops; other mixtures may be cheaper or more suitable in particular cases. The total quantities stated should be sufficient for one acre under average conditions. Other manures can be mixed together to give approximately the same composite

analyses, but only such as do not interact on each other chemically should be used for this purpose (see above).

In each case the percentage composition of the mixture has been ascertained by multiplying the weight (in cwt.) of each manure by its content of nitrogen, phosphate or potash, as the case may be, and dividing by the total weight of the mixture. The manures used are sulphate of ammonia containing 20 per cent. of nitrogen, superphosphate containing 30 per cent. of soluble phosphate, steamed bone flour containing 1 per cent. of nitrogen and 60 per cent. of insoluble phosphate, and sulphate of potash containing 49 per cent. of potash. Maximum selling prices have been arranged for potash manures and sulphate of ammonia, particulars of which are set out in circulars F.P. 501/S1 and F.P. 495/S1. Copies of these circulars may be obtained on application to the Ministry at 72, Victoria Street, London, S.W. 1.

Wheat, Oats, Barley.—For application at seed time, or early spring for wheat after a corn crop and not yet manured—

Sulphate of ammonia, $\frac{1}{2}$ cwt. = $\frac{1}{2} \times 20 \times 4/13 = 4.6$ Nitrogen.

Superphosphate, $1\frac{1}{2}$ cwt. = $3/2 \times 30 \times 4/13 = 13.8$ Sol. phosphate.

Steamed bone flour, $\frac{1}{2}$ cwt. = $\left\{ \begin{array}{l} \frac{1}{2} \times 1 \times 4/13 = .1 \text{ Nitrogen.} \\ \frac{1}{2} \times 60 \times 4/13 = 9.2 \text{ Insol. phosphate.} \end{array} \right.$

Sulphate of potash, $\frac{1}{2}$ cwt. = $\frac{1}{2} \times 49 \times 4/13 = 7.5$ Potash.

The percentage and composition of the mixture is, therefore :—
4.7 nitrogen, 13.8 soluble phosphate, 9.2 insoluble phosphate, 7.5 potash.

Mangolds.—For application at seed time—

		<i>Per cent.</i>
$1\frac{1}{2}$ cwt. Sulphate of ammonia ..	} containing	Nitrogen 5.7
$2\frac{1}{2}$ „ Superphosphate ..		Sol. phos. 14.3
$\frac{1}{2}$ „ Steamed bone flour ..		Insol. phos. 5.7
$\frac{1}{2}$ „ Sulphate of potash ..		Potash 7.0

In addition it is advisable to apply *separately* about 4 cwt. per acre of common agricultural salt.

Swedes, Turnips.—For application at seed time—

		<i>Per cent.</i>
$\frac{1}{2}$ cwt. Sulphate of ammonia ..	} containing	Nitrogen 3.0
3 „ Superphosphate ..		Sol. phos. 17.1
1 „ Steamed bone flour ..		Insol. phos. 11.4
$8\frac{1}{2}$ „ Sulphate of potash ..		Potash 4.7

Potatoes, Carrots.—For application at planting and seed time—

$1\frac{1}{2}$ cwt. Sulphate of ammonia ..	} containing	Nitrogen 3.9
$3\frac{1}{2}$ „ Superphosphate ..		Sol. phos. 16.2
$\frac{1}{2}$ „ Steamed bone flour ..		Insol. phos. 7.0
1 „ Sulphate of potash ..		Potash 7.5

Beans, Peas, Lucerne, Sainfoin.—For application at seed time for beans and peas, and as a spring top-dressing for lucerne and sainfoin—

		<i>Per cent.</i>
$\frac{1}{2}$ cwt. Sulphate of ammonia ..	} containing	Nitrogen 2.0
$3\frac{1}{2}$ „ Superphosphate ..		Sol. phos. 19.1
1 „ Steamed bone flour ..		Insol. phos. 10.9
$\frac{1}{2}$ „ Sulphate of potash ..		Potash 4.5

"Seeds" Hay.—As for oats. For application in early spring.

Meadow Hay.—For application in early spring—

			<i>Per cent.</i>
1 cwt.	Sulphate of ammonia ..	} containing	Nitrogen 4.5
2½ "	Superphosphate ..		Sol. phos. 16.7
2½ "	Steamed bone flour ..		Insol. phos. 6.7
1½ "	Sulphate of potash ..		Potash 5.4

The main object of introducing steamed bone flour into the mixtures is that it may act as a "drier" and thus facilitate distribution. Fine bone meal or castor meal might be used instead, with similar effects.

(This article is also issued separately as Leaflet No. 344.)

FARMING OF THE UNITED KINGDOM IN PEACE AND IN WAR: THE PLOUGH POLICY AND ITS RESULTS.*

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WHITE races, especially the peoples of the British Empire, Central Europe, and the United States, largely increased their consumption of meat in the period between the Napoleonic and the Great War. From the standpoint of economy in food this has been an expensive change, since the amount of human food that may be produced from the soil in the form of meat is much less than the quantity that may be produced in the form of grain and vegetables. It follows that for peoples who during war are compelled to live on a meagre diet, or who, in reaping war's aftermath, are required to restore civilisation and to study economy in personal expenditure, there is no better food policy than to return to the sufficient, if less attractive, diet of their forefathers. During the period of reconstruction and poverty that must follow war, as well as throughout the struggle itself, a prudent nation should adopt the motto "Down Horn, Up Corn," *i.e.*, they should reduce expenditure on the products of live stock and increase expenditure on the direct products of the soil.

This may seem to be a strange motto for a year, characterised so far as British agriculture is concerned, by higher prices for cattle than have ever been known before, and it must in particular appear strange to the farmer, whose experience in

* An address delivered to the Agricultural Society, University College of Wales, Aberystwyth, on 19th December, 1919.

the past half century has taught him that the converse motto "Down Corn, Up Horn" has saved him from financial ruin.

It would ill become me to condemn the farming policy which has been adopted by British agriculturists since the "'seventies." It was a system of husbandry well adapted for a rich country ready to pay for all the beef and mutton that could be produced, well adapted, too, for a nation that took cheapness, not certainty of supply, as the gauge of a satisfactory food policy, and that regarded the soil as raw material for the creation of wealth, not as a storehouse from which ample stocks of food might be provided.

Moreover, our recent system of farm management fitted in with the commercial policy of the Nation; during the past 50 years Britain cultivated the resources of the sea as steadily as she neglected the resources of her home land. When, after the disastrous harvests of the late "'seventies," stock-farming began to supplant corn-growing, grain was a commodity which could easily be carried in ships; but meat could not, and live cattle were indifferent occupants of cargo space. By transferring our corn-growing to other lands we were not only saved the necessity of tilling our own fields, but we provided valuable merchandise for sea transport and a convenient commodity for which our manufactured goods could be bartered. There were, therefore, reasons which appealed to others than farmers for abandoning tillage, for importing bread corn, and for producing meat at home.

It is true that before the outbreak of war the early position had been modified by the development of the trade in chilled and frozen meat; but meat production had secured a strong hold on the British farmer and the quality of home fed meat on the British public. Thus when war broke out stock-farming was universally admitted to be not only the paramount British industry, but to be the only type of farming worth serious consideration in most parts of the country.

Methods used in estimating the Food Requirements of Nations.— I shall presently contrast the importance of stock-farming and corn growing as it existed before the War: but let me first allude to the methods used in estimating the food requirements of nations and the food-producing capacity of cultivated land.

The policy specially associated with the Food Production Department came as a shock to the average agriculturist. He could not understand the actions of those whom he termed

the "plough maniacs." To him it seemed as if the emissaries of the Department were bent on destroying a sure and certain supply of food in search of problematical advantages. "Are not beef and mutton," he asked, "as necessary foods for men and women as wheat and oats." "When our children cry for milk can we offer them potatoes."?

In adopting a plough policy, it may here be remarked, the Food Production Department were not forgetful of the commercial advantages of stock-farming on grass land; but in facing the conditions imposed by war, their problem was to secure the largest possible amount of human food from the soil of the country. In giving effect to this policy they were limited by scarcity of labour and manure, and it was, therefore, necessary to adapt their methods to the special circumstances of the time and to neglect the less important question of farming profits.

In ascertaining the food needs of a whole country, the total requirements may be estimated by different methods. In pre-war times, when the country could import what it wanted, it was merely necessary to purchase the number of tons of beef, mutton, wheat, sugar, butter, etc., for which there was an effective demand, but, on the outbreak of war, these commodities could not be secured in unlimited quantities, and, as the War progressed, ships could not be provided to carry all the foodstuffs that could be purchased in other countries. We had, for example, to substitute margarine made from West African palm-nut kernels for Danish butter, and American maize for Australian wheat. In feeding the human population we had, therefore, to adopt the methods familiar to farmers in connection with the preparation of rations for live stock, and to provide from the best available sources the essential proteins, fats and carbohydrates required in food.

In dealing with a large mixed population, so long as a sufficiency of bread, margarine and milk can be assured, the best means of comparing the value of one foodstuff with that of another is to determine what is known as the "energy value." Most of the food which is eaten is burnt up in the body, just as fuel is burnt up in the furnace of a boiler, and in "burning" it produces energy which maintains such vital processes as the movement of the muscles, the circulation of the blood, and digestion. As the result of the food eaten, work is done by the body, just as work is done by a locomotive because of the energy released from the coal consumed in the furnace.

The unit employed to measure "energy value" is the Calorie, that is, the quantity of heat needed to raise 1 kilog. of water from 15° to 16° C.

The number of Calories which must be supplied in food depends chiefly on the nature of a man's work. When resting in bed, and it is only necessary to maintain the vital functions, it has been found that a man of average weight uses up about 1,850 Calories per day. If engaged in very light work, *e.g.*, walking to a classroom and listening to lectures, not less than 2,500 would be required; assuming a normal amount of exercise 3,000 to 3,500 would be necessary. In hard training the potential "blue" may need 5,000, or more.

Before the War the average amount of food provided per man in the United Kingdom would supply about 3,400 Calories per day, or, including women and children, about 1,130,000 per head per annum for the whole population of the country. For purposes of calculation, we may take the round figure 1,000,000 Calories per person per annum as representing the needs of a mixed population in the United Kingdom.

Chief Farm Products of the United Kingdom.—We may now proceed to study the agriculture of the United Kingdom as it existed before the War, for the purpose of discovering the relative money values and food values of the crops and live stock which we then produced.

In Table I. (p. 1196) I have brought together the necessary data. The figures are the annual averages for the five-year period, 1909-13. Prices are given per customary unit, *i.e.*, per qr. of wheat, per cwt. of meat, butter, etc., and per gal. of milk; the weight sold is shown in thousands of tons; the money value in thousands of pounds; and the energy value in millions of Calories. The upper part of the table gives details, the lower presents a summary.

It is apparent at a glance that in the United Kingdom live-stock farming was paramount. It may be shown that 36,000,000 acres were devoted to producing meat and milk as against 2,950,000 to the growing of wheat and potatoes. The sales of live stock and of stock products totalled some £151,000,000 per annum, while wheat and potatoes produced £26,750,000 only.

The entire food supply of our live stock is not, however, produced from the soils of the country. We import feeding stuffs for which farmers paid some £32,000,000 per annum in 1909-13. These feeding stuffs have considerable manurial value, and we may write off £6,000,000 as the sum due for

manure by the land used for raising other saleable products than live stock. This would indicate the value of the live stock and live-stock products of the United Kingdom to be £125,000,000 per annum in the period 1909-13.

It may be remarked in this connection that the trade in exporting cattle and sheep, though valuable to those engaged in it, was relatively very small in the period under review.

Let us now turn our attention to examining the returns *per acre* in money and food which we get from the land of the United Kingdom.

When for "total value" we substitute "value per acre" there is less reason for the complacency with which we have hitherto regarded the results of our live-stock farming. When

TABLE I.—YIELD AND VALUE OF THE CHIEF FARM PRODUCTS OF THE UNITED KINGDOM, 1909-13.

Column 4 includes the value of by-products—Hides, Wool, Potatoes used for Feeding, etc.

Product.	Price.	Quantity Sold.	Money Value.	Energy Value.
		Tons.	£	C.
Wheat (1,800,000 acres) ..	32s.	1,393,000	12,000,000	3,600,000
Potatoes (1,150,000 acres) ..	70s.	4,000,000	14,750,000	4,000,000
Beef and Veal	57s.	810,000	52,000,000	2,380,000
Cattle Exported	—	—	196,000	—
Mutton and Lamb	62s.	326,000	25,000,000	1,072,000
Sheep Exported	—	—	59,000	—
Pork, Bacon, Ham	63s.	400,000	25,000,000	1,814,000
Milk	8d.	4,430,000	32,000,000	3,220,000
Butter	130s.	112,000	14,580,000	900,000
Cheese	73s.	29,000	2,150,000	116,000
	—	—	178,000,000	17,100,000

SUMMARY AFTER DEDUCTING THREE-FOURTHS OF VALUE OF IMPORTED FEEDING STUFFS.

	Acres.	Money Value.		Energy Value.	
		Total.	Per Acre.	Total.	Per Acre.
	000	£000		C.	C.
Wheat, Potatoes	2,950	26,750	182s. 9d.	7,600,000	2,576
Live Stock	36,000	125,000	69s. 5d.	8,000,000	'222

a deduction for imported feeding stuffs has been made we find that the receipts from live stock come out at about 6gs. 5d. per cultivated acre (the very considerable value of the stock grazing, some 15,000,000 acres of mountain and heath land, has been thrown in) as against 182s. 9d. per acre realised from wheat and potatoes. When, further, we examine the energy value of the products raised, the relative importance of stock and of crop farming takes an entirely new aspect. Whereas the energy value of the former is but .22 million Calories per acre, the energy value of the latter amounts to 2.57 million. In other words the meat, milk, etc., produced by 100 acres devoted to stock farming would supply energy for 22 persons for a year, while 100 acres cropped with wheat and potatoes in the proportions indicated in Table I. would provide a supply for 257 persons.

A few additional figures indicating the production of energy by common crops may be of interest in this connection.

If the average yield of our crops be taken, it may be shown that each 100 acres under crop would provide energy for the following numbers of persons: Wheat about 200, potatoes 400, oat 150, mangolds converted into meat 40, meadow hay converted into meat 12 to 14. If, further, we assume a farm to be worked on a six-course rotation—wheat, potatoes, oats, roots, barley, clover—it may be shown that, per 100 acres, energy for about 150 persons could be produced; on grass land of average quality, half producing meat and half milk, the corresponding figure would lie somewhere between 15 and 20.

Production on Ploughed Land and Grass Land.—Some years ago in giving evidence before Lord Selborne's Reconstruction Committee, I estimated that before the War the ploughed land of the country was feeding 84 persons per 100 acres, while the grass land was probably feeding about 20. From the figures in Table I. above, it would seem that this estimate of the production of grass land was too high. At that time I calculated the yield from grass by three methods, which gave the figures 17, 20 and 21 respectively. Table I. indicates that the joint produce of some 14 million acres of arable land and some 22 million acres of grass provide energy for 22 persons per 100 acres. I have not actually calculated the respective shares of the grass and arable, but if this were done it would be found that the figure for the number of persons maintained by 100 acres of average grass land before the War was nearer 17 than 20.

In this connection I should explain that the figures showing meat production in the period 1909-13 are based on the official figures of the Ministry of Agriculture and the Board of Trade. The experience of the Ministry of Food points to the conclusion that we have over-estimated our pre-war home meat supply.

The Population maintained by British Soil.—The changes in our system of farming in the past 50 years have had one result which I believe few among us have realised. It is that, in spite of the great advances made by British farmers between the close of the Napoleonic wars and the depression of the late 'seventies, the population we were feeding from our own soil in the period 1909-13 was little greater than it was a century before, and it was substantially less than it was 75 years ago.

In the period 1801-10 the soil of the United Kingdom fed about 16½ millions, and in the period 1831-40 about 24½ millions, while in 1909-13 I estimate the number to have been 17½ millions. The standard of living had, of course, much advanced by the beginning of the 20th century; beef and mutton were more plentiful, oatmeal and potatoes were less in evidence; but in spite of this change in the quality of the food British agriculture has no reason to be proud of the results of her efforts to maintain the British people. It is true that the British people did not ask to be supplied with food from their own land, and more and more relied on imports; thus they entered on the World War with a supply of home-grown food that would last them from about 6 p.m. on Friday till 10.0 a.m. on Monday in each week. Nor is there, it may be remarked, any substantial change to-day; we are more or less cheerfully, according to our dispositions and our knowledge, or want of knowledge, facing a world situation which, in the matter of food production, no one can forecast, with a week-end supply assured from our own land.

The Plough Policy.—It was generally known that the greater part of Britain's food supply came from overseas, but in 1914 it was not generally realised that from the products of our own soil we were feeding a population very little larger than the population which the land of the country maintained a century before. Nor was it realised that this state of affairs was largely caused by the system of husbandry which our farmers were forced to adopt because of the depression of the late years of the 19th century.

In September, 1915, in a paper read before the Manchester Meeting of the British Association,* I contrasted the effects which the adoption of different systems of farming had upon the nation's food supply, and from time to time thereafter I urged the importance of breaking up grass land; but, though a plough policy was widely advocated in the autumn of 1915, no active steps to secure the ploughing up of grass land were taken.

In 1916 in a Memorandum on "The Recent Development of German Agriculture"† I contrasted the farming system of Britain and Germany in their effect on food supply, and indicated that our enemy was able to feed about twice as many people per 100 acres as we were, and that this was not due to the larger crops grown in Germany, but to the greater area under tillage. The lessons of this contrast were enforced by the position of our food supplies at the time.

The year 1916 was a disastrous one from the standpoint of the Allies' food. The wheat crops of North America and the potato crops of Europe were very poor. It was clear by the autumn of the year that there would be a great shortage of both bread stuffs and potatoes in the following season. Potatoes, indeed, were very scarce as early as November, 1916.

Immediately after the change of Government in December, 1916, the new President of the Board of Agriculture (Mr. Prothero) decided to set up a special Department of the Board to promote the interests of food production. In January, 1917, the Food Production Department started its existence at 72, Victoria Street, and the new Agricultural Executive Committees began work in their respective counties. During the month the food outlook grew steadily worse, and public interest in food production was thoroughly aroused.

Good progress was made by the movement, and even in 1917 substantial additions to the area under corn and potatoes in England and Wales were secured. But by the spring of 1917 farmers had already, for the most part, settled their cropping for the year, and it was recognised that no great increase in production would be possible until the following season. Attention was, therefore, concentrated on preparations for the harvest of 1918.

In the first place, estimates were made of the greatest area which could be got under tillage assuming all conditions to be favourable; a programme for each county was then

* See this *Journal*, September, 1915, p. 520.

† " " " August, 1916, p. 426.

drawn up ; and a survey was arranged and estimates were made of the men, horses, and machinery that would be required to carry out the programme. Needless to say there were very great difficulties to be surmounted, both by the Agricultural Executive Committees in finding the land and by the central Department in securing labour, machinery and supplies. I do not, however, propose to dwell on our methods or our difficulties, but to pass on to the results.

Table II. shows the change in the cropping of England and Wales in 1918, as compared with the pre-war period 1905-14 ; figures for 1871-75 are also given.

From this Table it will be seen that the " average 100-acre farm " of England and Wales had 44 acres under crops other than grass and fodders in the 'seventies, that this area fell to 31½ acres before the War, but that in 1918 there was a sharp recovery, and the average farm had 38 acres under tillage. The area under corn in 1918 was only 1 per cent. less than it

TABLE II.—ENGLAND AND WALES.

Crops and Live Stock per 100 acres of Cultivated Land.
(The " average " 100 acres of Cultivated Land has, in addition,
14 acres of Hill Pasture available for Stock Raising.)

	1871-75.	1905-14.	1918.
Permanent Grass	44.4	58.4	54.0
Rotation Grasses, Clovers, Sainfoin, Lucerne	11.5	10.1	7.9
Total Grass and Clover	55.9	68.5	61.9
Cereal Crops	27.2	19.6	26.2
Including Wheat	12.8	6.4	9.5
Beans and Peas	3.3	1.6	1.5
Potatoes	1.4	1.6	2.3
Turnips, Swedes, Mangolds	7.4	5.7	4.9
Cabbage, Rape, Vetches, etc.	2.5	1.8	1.7
Bare Fallow	2.3	1.2	1.5

STOCK.

	1871-75.	1905-14.	1918.
Agricultural Horses (including Colts)	4.2	4.7	4.3
Cow and Heifers in Milk or in Calf ..	6.8	8.6	9.6
Other Cattle	10.8	12.7	13.4
Sheep	81.4	68.6	61.0
Pigs	8.7	8.7	6.3

was before the depression, and the area under potatoes was 1 per cent. greater. If we take the crops chiefly grown for human food—wheat and potatoes—we find 12 acres on the average 100-acre farm of 1918, as compared with 8 acres before the War and 14 acres in the period 1871-75.

In the early part of 1918, however, no criticism of the work of the Food Production Department was more familiar than that "acres" were being sought after at the expense of "bushels," and quite a number of our critics prophesied that when, after harvest, the gains and losses were reckoned up, the net result would be trifling.

Let us, therefore, compare the harvest figures of 1918 with those of the pre-war period of 1905-14. Figures, based upon the Agricultural Returns, are given in Table III.

TABLE III.—ENGLAND AND WALES.

Production of Grain and Potatoes, 1905-14 and 1918: Figures in thousands of tons.

Crop.				Total Yield.		Increase or Decrease (—) in 1918.	
				1905-14.	1918.		
						Weight.	Per Cent.
Wheat	..	..	..	1,534	2,339	805	52
*Barley	..	..	..	1,190	1,228	38	3
*Oats	..	..	..	1,457	2,056	599	41
Rye ..	..	..	..	25	63	38	150
Beans	..	..	..	243	206	—37	—15
Peas	..	..	..	115	100	—15	—13
Total Grain	..	..	..	4,565	5,993	1,428	31
Potatoes	..	..	..	2,678	4,209	1,531	57

From the figures in this Table it will be seen that in the last year of the War (favoured, it should be remarked, by a season better than average) England and Wales produced 52 per cent. more wheat, 41 per cent. more oats, 31 per cent. more grain of all kinds, and 57 per cent. more potatoes than on the average of the period 1905-14. Reckoning potatoes as equal to one-fifth of the weight of grain, the increase in grain crops and potatoes equalled some 1,733,000 tons.

The root and hay crops of 1918 occupied a smaller area and were lower in yield than the average, and, assuming the reduction to have been borne by beef and mutton (not by milk and

* In 1918 "mixed corn" was "returned" for the first time. The estimated yield was 620,000 qr. As "mixed corn" consists chiefly of barley and oats the produce has been added to the barley and oat crops of 1918 in equal amounts.

pork) we may have lost, because of this shortage in fodder (but probably did not lose) as much as 100,000 tons of meat. After making a deduction for this loss, the net gain in 1918 represented 1,633,000 tons of human food. To bring this food into the country it would have been necessary to charter vessels having an aggregate capacity of 2,300,000 shipping tons of 40 cubic feet.

These changes, it will readily be understood, were not secured without a very great deal of work which fell not only upon farmers themselves and their men, but also on members and officers of the Agricultural Executive Committees, and on the staff of the Food Production Department.

The following figures will indicate the scale on which the Central Department was organised. Starting with some 30 permanent officers of the Board of Agriculture and Fisheries, a staff of about 1,000 was employed in 1918. Before the end of 1918 the controlled labour supplied to Agricultural Executive Committees through the Department included 118,000 persons, of whom 72,000 were soldiers, 30,000 prisoners of war, 4,000 war volunteers, and 11,500 Land Army women. By this time, too, the Department owned 4,200 tractors and 10,000 horses, with many thousands of implements and sets of harness. In addition a great deal of work was done in supplying fertilisers, distributing seeds, and providing such necessities as binder twine.

The cost of all this work was necessarily high, but there was much more than a direct return in the value of the extra crops secured; crops which, but for the action of the Department, would never have been grown: and, needless to say, it was not for a pecuniary profit, but as an insurance against the risk of starvation that the Department was established.

Could the United Kingdom become self-supporting?—It is sometimes stated that given suitable encouragement by the State, and an ample supply of machinery and manures, the soil of this country might provide us with all the bread-stuffs we require, and at the same time maintain the present production of milk, beef, and mutton.

Let us examine this view, first, as a Peace proposition. Assuming that by good farming we could not only largely extend the area under corn, but maintain the existing average production of the soils of the United Kingdom, the figures in Table IV. show the area that would be required to provide us with all the cereal grain (except rice and certain millets) used in the United Kingdom in the period 1909-13.

TABLE IV.—AREA NECESSARY TO GROW ALL THE CORN USED IN THE UNITED KINGDOM.

Maize replaced by other Cereals. Rice and Millets omitted. Land assumed to produce an average crop of the period 1909-13.

—	Wheat.	Barley.	Oats.	Rye.	Total.
	Tons. 000	Tons. 000	Tons. 000	Tons. 000	Tons. 000
Grain or Flour, etc., as					
Grain Imported, 1909-13	5,805	1,070	948	49	7,872
Maize equivalent	292	1,240	1,056	—	2,588
Addition for Seed	677	192	143	4	1,016
Total extra Grain required	6,774	2,502	2,147	53	11,476
	Acres. 000	Acres. 000	Acres. 000	Acres. 000	Acres. 000
Area wanted for extra Grain	7,527	3,127	3,006	67	13,727
Area in United Kingdom, 1909-13	1,887	1,845	4,040	62	7,834
Total Area necessary ..	9,414	4,972	7,046	129	21,561

In the Table I give the weight of wheat, barley, oats and rye imported in the average year of the period 1909-13. As maize cannot be grown here, it has been replaced by other cereals. I have assumed that one-eighth would be replaced by wheat, half by barley, and three-eighths by oats. I have next added the quantity of seed that would be required to produce the imported grain, and I arrive at a figure of 11,476,000 tons as representing the total extra requirements of cereals. It would take 13,727,000 acres to grow this weight of grain, and adding the 7,837,000 acres already under white crops we arrive at a figure of 21,564,000 acres, as the total area that would be wanted if the United Kingdom were required to grow its own corn. The present average yield could not be maintained on so large an area, if we had to depend on the varieties of wheat, etc., now available; but assuming that the difficulty of maintaining the average yield were overcome, we should still have to hunt for suitable land. Continuous corn growing we may put out of consideration, except in certain parts of the Eastern and South-Eastern Counties, and if I were ordered to grow 21½ million acres of corn in the United Kingdom I would demand for the purpose some 43 to 45 million acres of arable land; otherwise it would be impossible, however great were my resources in labour and capital, to maintain the land itself in a reasonably good state of cultivation. But there

are less than 47 million acres of cultivated land available altogether. So that the task of finding 43 millions for the purpose would clearly be impossible.

But let us examine a more practical question. Assuming that the United Kingdom were engaged in another great war, that stocks in hand and imports could supply bread-stuffs until after the second war harvest and that, profiting by the experience of 1914-18, immediate steps were taken to increase production, could the country be starved into surrender? There may never again be such a war as that which we have experienced, and if there were we cannot predict what size of population the soil would be called upon to support; but the answer is still worth attempting while the experience of 1918 is fresh in our memories.

To provide the minimum rations of bread that would be required to maintain the present population of the United Kingdom in health, and in addition to provide small rations of grain for farm horses, cows and other essential live stock, it would be necessary to grow about 14 million acres of corn. The approximate cropping of this area would be :---

5,000,000	acres of wheat	} for human bread-stuffs, meal, etc.
2,500,000	„ barley	
3,000,000	„ oats	
3,000,000	„ oats ..	
3,000,000	„ oats ..	for live stock.
500,000	„ barley	for brewing or munitions.

In the year 1918 Ireland grew 1,933,000 acres of corn. In any future war, as in 1914-18, the live-stock and potato industries would be likely to receive closest attention, we might put the Irish contribution to the total grain area at 2,000,000 acres. It would thus be necessary to secure 12,000,000 acres within Great Britain. The actual area grown in 1918 was: England and Wales, 7,080,000 acres; Scotland, 1,370,000 acres; or 8,450,000 acres in all. This would leave the authorities the formidable, but, in my judgment, by no means impossible, task of securing in the second season after the outbreak of hostilities $3\frac{1}{2}$ million acres more corn than Great Britain grew in 1918.

THE FAREWELL RALLY OF THE WOMEN'S LAND ARMY, AND A RETROSPECT.

N. FRIDA HARTLEY.

THE 27th November last marked the return to more normal labour conditions in agriculture by a Final Rally of the Women's Land Army. It was held in the Drapers' Hall, London, where Princess Mary presented Distinguished Service Bars to 57 women, all of whom had won their honours for deeds of bravery or special skill or devotion in their duties.

Those who were present received a very forcible impression of the high standard of physical strength in the women and of their general appearance of freshness after their hard service. These massed groups of girls from the counties represented a page in the history of agriculture and an epoch in their own working lives. If it is contended that they were a picked lot and stood for the flower of the Land Army, it must also be remembered that, coming in the first place from all classes of industrial life, many of them had been made or had made themselves what they are to-day.

The two and a half years of the life of the Land Army, may be said to border on romance. The scheme appeared as one item in the National Service programme of 1917, without precedent and without any assurance of success. It was built up in doubt, launched in a sea of opposition, and had perforce to sink or swim on its own entirely untried merits. Its romantic element comes in a peculiar triumph of its own, which it has gained by its own struggle against obstacles and because it has in the end achieved so much more than its own original intentions of providing a stop-gap for labour shortage.

It is fully recognised by now that during its lifetime two time-worn notions, both strangely contradictory one to another, have decayed and crumbled into ruins ; one, that this land work which the women have found to be so worthy a thing, was beneath female dignity, and the other that agriculture, in which they have found so good a place, covers at the same time too robust a field of knowledge and makes too large a demand on physical strength to find a place for their finer perceptions and powers of mere personal devotion. The breaking down of the barriers and the discovery that, after all, this fineness of perception and power of devotion were,

to a remarkable degree, adaptable to certain aspects of farm life, and the consequent opening out of a new career to women with pluck and determination, may be called the professional triumph of the Land Army.

But there are other and more human issues none the less valuable, and one felt that it was essentially the human and individual point of view that was touched upon that night of farewell. The atmosphere, as one by one the women walked unostentatiously up the dais to receive their honours, suggested to those who understood the needs of the working girl nothing so much as a great awakening and a great renewal. It was charged with hope and with infinite possibilities for her future as well as of her present triumph against odds. The hope indeed touched upon other results of the great struggle made by women on behalf of women than one newly-opened career, and suggested for the years to come a raising of the whole status of the industrial class of working women, and of new efforts to be put forth by those who had the results of her training before their very eyes that night of commemoration.

For those who knew the conditions under which the poorer class of girls worked before the War have been literally amazed, not at the change that had been made in them—for they had long ago realised the good stuff they had in them—but the rapidity in which this change had been brought about. The loafer and the unintelligent factory hand have left inconsequence and apathy behind, and from the mere wage-earner had developed into the enthusiast. One has only to know one or two cases to realise how wonderful this transformation has been. Patriotic instincts, for the most part unborn in this class of girl, gave keenness at the start and *esprit-de-corps* as time went on. The training and the individual care filled as large a blank in the life of the poor worker as she and her kind had done in the labour shortage, and their hope lay also in the new knowledge of those who had not realised this before. There had been something else in the making of the successful land girl than the freshness of open-air life and the mysterious contact with Nature which has power to touch the fundamental in the human being. The mere dealing with the Natural elements without the accompanying use of the brain and the perceptions is apt to dull, and it was because the land girl has been inspired at the start to work with a purpose and an ideal, that her development was so sound, and her progress so marked. The new effort literally kindled her into life.

And there was another side to the picture that night, for it touched upon the best of things by which, after all, all hopes of progress must be judged. One felt with all the inevitable jars which had attended the administration, and the acceptance of so unprecedented a scheme, the entrance of the young Land Army girl into the somewhat tired agricultural world, with her Women Organisers behind her backing her for every ounce she was worth, and the girl, herself ignorant as she was full of the eagerness and of the appeal of youth, had really had a remarkably refreshing and humanising effect upon agricultural conditions and upon the British farmer himself. The writer, hailing from a county where a certain dry kindly humour is often the saving grace of a temperament stifled by hard conditions and labour, is convinced that the very troubles of the new worker, the absurd happiness of her, the whimsicality, and, in short, the utter unexpectedness of her, had the most wholesome effect of all from a human point of view upon the older-fashioned men!

That the advent of this whimsicality and this unexpectedness would have caused an outcry indeed in the farming world which has, perforce to take itself very seriously, had it not been accompanied by a steadily growing efficiency, goes without saying! One shudders to imagine the results of the materialisation of the nightmare regularly dreamed by one of the oldest types of farmers: that a bevy of "finnickies, nonsensical ladies, with skirts held up and buttoned up boots," had, by order of the Government, invaded his farm, turning up their noses at his pigstyes, and his muck heap, spoiling by their dignified presence his after-dinner nap, smoke and joke. After long persuasion the dream of that farmer did materialise, but to his utter amazement it took the form first of a shy, eager trainee, in a dress which he would not have dared to contemplate before but of which he saw the peculiar suitability, and, after he had used a little patience, of a strapping, commonsense land girl who kept his yard and his pigstyes as he had never kept them, and was quite as ready for her joke and her smoke after supper as he was himself. He took great credit to himself for the result of his patience, but to the end he declared that she was addicted to tantrums quite peculiar to her sex which, together with his pride in her, so tickled his fancy and his sense of humour that he became a wiser and, strange to say, a happier man. The old-fashioned farmer has been blamed for prejudice at the start, and prejudice there undoubtedly was, but it was a natural sequence to old conditions, and to traditions which had more of dignity than is commonly supposed.

Much of his doubt was due to a perfectly natural sense of chivalry, and the dislike of the idea that a woman should have to do the rough work which his man had always done. In his opinion it was not the time for such considerations as better housing, a new standard of wages, and hours, and government interference. It must have seemed to many men that the demand for this consideration only proved his contention that general farm work was not suitable for women, except at seasonal times when they might be employed locally because he could not do without them. Then, when it was clearly explained to him that he could not even merely supplement his labour with organised and subsidised women labour but must accept the latter wholly with its attendant conditions, and when growing shortage compelled him to give up the idea that the scheme was instituted merely for the pushing of women into agriculture, he settled down and matters began to improve.

He soon began to see that if he was to get the best out of his girl he must give her a chance, give her time to do the all-important thing in the eyes of the small farmer—"get into his ways." In the North of England, at any rate, where a farmer's ways are very much his own and very little those of anyone else, this is the essential thing, and he began to use patience. With patience, if the girl was willing and had commonsense, came interest, and soon he began to watch her progress with a kindlier eye than merely to mark her increasing worth of her wage. It has been a joy to watch the growing companionship and understanding between some of the best of the women and their employers, and the way in which the latter have fallen in with the more individual and human outlook of the women. "That gell," remarked a farmer, leaning over his gate with his pipe in his mouth and watching his young worker handling calves with a sort of passionate deftness in her movements, "treats they calves as if they was babies instead of machines in the making, and blame me if I don't think they're the gainer all along. What there is in beasts she gets out of them, and that's a deal more than I ever thought to look for before."

Some very creditable all-round farm hands began to show themselves amongst the newly-trained girls, together with some extremely creditable milkers and stockwomen. Then there came those women who in the face of a storm of doubt and incredulity had specialised—the thatchers, the threshers and the tractor drivers. The thatchers could not be supplied fast enough, the threshers—a job which many of the farmers

stoutly declared to be far too hard for women—were fully employed, and there was no more popular work amongst the girls. The tractor drivers went ahead and took the field with honours, and interest grew stronger. There was amongst the women who received the Bar that night, one who had ploughed land which no man cared to touch, and yet she possessed, apparently, no undue measure of physical strength. Employers began to be convinced of a fact which the pioneers amongst them had contested all along, that although a woman could not take the place of a man in point of view of physical strength and a general day's work, she could in certain circumstances achieve by her quickness of perception and deftness of handling and by the very enthusiasm of youth, what he could or would not, and it was just there that the women began to rouse the honest recognition of the more backward employers. They saw that although her sphere of work on his farm might be limited, it was none the less valuable within its own scope. There is no more appreciative man than the British farmer if he feels that he is getting his money's worth and is not being imposed upon.

In one county where opposition to female labour had been very strong, a farmer used to watch the work of the tractor driver for hours and then go home very much more disposed to be patient with his own little struggling farm hand, and less inclined to dub the whole Land Army a "wash-out" because there had been a considerable number of failures. The progress of the Land Army had reached a stage where only a few signal successes were needed to turn the tide in its favour. Incredulity died a natural death, and those amongst the employers who had been the pioneers of the scheme began to breathe freely.

Failures! A whole chapter might be written on the subject of failures both from their own and from their employer's point of view. For the Organisers of the Land Army would be the first to recognise that the waste material must have been a sore trial to an overworked farmer during those first trying months. There were those girls who began badly, did not know how to use their new freedom or responsibility, and then tried again and became excellent workers. But there were others who could not regain the ground they had lost, or who had never had the backbone to stand a new test of any kind, and these, after unconsciously pulling down the prestige in their neighbourhood, themselves knew the bitterness of ignominious

discharge. There were many who tried and persevered and failed, not actually on medical grounds, but owing to lack of physical or nervous staying power. Has it ever been fully realised by those who took young girls from town surroundings, what a severe test to their nervous powers the new work and the strange surroundings constituted? Many of them were young enough in all conscience! Poor little failures of the Land Army; they were so inevitable! But it must be remembered that the greater number of the women came forward with good intentions but utterly without means of gauging their own powers of skill or endurance beforehand. But the country owes its debt of gratitude to all those who answered the call to National Service only to fail, and the Organisers recognising this, and having no funds or officers to meet the purpose, yet did what was possible to place these girls on a safe footing after their return, and will doubtless always be glad to remember that they did so.

The percentage of women released solely on medical grounds from April, 1917, to June, 1918, was found to be approximately 6 per cent.—an astonishingly small number considering the elements of uncertainty which had to be weighed in the balances against success. For what after all was the history of the beginning of the Land Army?

When the subsidising of the scheme was finally decided upon, the Organisers had absolutely nothing to draw upon either in the way of precedent or material. Now that the scheme has won its way and fulfilled its object, and now that women are about to take advantage of all that has been won for them, the stupendous task which the Organisers had before them should be remembered. The Director and those in council with her must have pondered long upon the distressing problem of how to make something grow out of nothing! There was no foundation for a staff, and it was a scheme which needed a specially gifted staff. There were no land girls on the scale required, and it seemed extremely doubtful whether women could or would leave their own homes and consent to be mobile, or, beyond the fact that women in certain parts of the country had worked at seasonal times and in a purely local way, that they would consent to do the rough work of the general farm labourer. The very fact that even this form of land work had been considered derogatory would seem to be against recruiting on any large scale. The workers must be drawn from the towns as well as from the country if a sufficient number were to be

raised, and the question of suitability was a very anxious one. Agricultural conditions in many parts of England were utterly unsuited to the sudden employment of women, and it seemed a bad time to ask farmers for a greater consideration in this respect. The rates of pay could but compete badly with those of most other war organisations, and volunteers could only be appealed to from a sense of patriotism or for love of work of which they had no previous knowledge. An important feature of the problem was the organisation of the voluntary workers all over the country for the stimulation of local labour—quite as important a feature of the scheme as the mobile force known as the Land Army. The Organisation in control of voluntary workers is always a difficult matter, and in most of the war services there has been no such element. One of the greatest obstacles which Miss Talbot—the Director of the Land Army—must have encountered was the utter uncertainty of the farmer as to the extent of the coming labour shortage, and the farmer is usually too harassed over actual problems to care to look far ahead.

The Organisers and those pioneers in the farming world to whom they owe so much must have lived and moved and had their being on hope and determination in those days, but in all branches of industry men were being called up and women were fitting themselves not by training alone but by actual experience to fill their places. Only a sudden turn of the tide of the War could avert the coming agricultural shortage, although farmers might be spared to the last. Determination merged into organisation, and organisation into action, and the rest of the unique history of the Land Army deals with the forced development for emergency purposes of the raw recruit into something as nearly approaching the finished article as possible, followed by the more normal growth of her own powers in such measure as she possessed them. Then the gradual absorption and adaptation of the whole scheme into the actual labour needs of the country, accompanied by steady progress which outpaced setbacks, a great deal of marked success, and finally the cordial acknowledgment of the adequacy of the Land Army as a whole. If women have, as farmers contended at the first, pushed their way into agriculture, they were called by patriotism and kept there by the grit and efficiency with which they filled the gap. The satisfactory fact has now been ascertained that 67 per cent. of the women have elected to work on under the Association. If they remain, as they

doubtless will, it will be because they have found a legitimate place which they may fill not as unwelcome competitors with men, but as fellow workers by means of their own particular gifts adapted to a new end. This is the legacy which Organisers and workers of the Land Army, in co-operation with the farmers, pioneers themselves, have left to women and to agriculture.

AGRICULTURAL HOUSING AND RENT OF COTTAGES.

THE following address was given by Lord Astor to the Agricultural Club at their meeting on 17th January, 1920 :—

I have come here to-night, representing the Ministry of Health, to speak to you respecting the necessity for providing the additional housing accommodation needed in this country ; but I hope you will realise that although I am principally concerned with housing, I am also deeply interested in agriculture. I can assure you that the Ministry of Health will constantly bear in mind the effects of their housing policy on agriculture and are very anxious to work in harmony and co-operation with the agricultural industry. In July last I met the Agricultural Wages Board and outlined to them the Government's housing policy. After an interesting discussion the matter was referred to the Cottages Committee of the Board for consideration. I notice that the Committee decided to postpone any decision on the matter, and because of that I have come here this evening to put to you the difficult points which I hoped you would solve.

In the first place, I think it necessary to have a few fundamental figures before us. The Ministry of Health's estimate of rural requirements was 100,000 houses at once. The total for the country was estimated at half a million. More recent returns show that 500,000 is an under-estimate, so that we may take it that 100,000 is the minimum rural requirement. There are also large numbers of inadequate houses and old cottages which must be replaced.

There is a real and urgent need for new houses. We want to get away from overcrowding, not only in the towns but also in the country. In the near future we must provide reasonable

accommodation for all our people. We must also bear in mind the fact that just as we desire to raise the standard of housing in the towns, so it is desirable to raise the standard in the country also. The families of agricultural labourers are on the average 16 per cent. larger than the families of the rest of the population, therefore the bedroom accommodation in rural areas should at least be as good as in the towns and cities. I emphasise this point because it has been said that the standard of housing laid down by the Ministry of Health is too high for the country ; but if we are going in for better housing then there is every reason why the higher standard should be applied in the country as well as in the town.

Now these 100,000 are not to be tied cottages, nor are they to be for the use of agricultural labourers only. In our opinion the bulk of these new houses will be in villages and hamlets. That will be a great advantage. It will facilitate the education of the children ; it will minister to the gregarious instincts of man ; it will permit of the provision of a better water supply and drainage. Moreover, the advent of the bicycle has made it possible for the agricultural labourer to live at some little distance from his work, which may be the case if the houses are built in the manner suggested.

The great difficulty with which we are faced at the outset is the cost of building. Cottages which might cost £350 before the War would now cost at least £700. We are so impressed at the Ministry of Health by the high cost of building that we are stimulating experiments with new methods of building and rediscovering old methods. We hope that in steel and concrete or pisé-de-terre we shall be able to build more cheaply in many districts. In some areas £100 to £150 may be saved by using these new or old methods in place of brick. Then also, the Government have put aside £15,000,000 as a subsidy, and we hope that landowners will come forward and join in providing houses with the inducement of the £150 subsidy for each house built within the next 12 months. We believe there is a nucleus of building labour in some rural districts which will not go to the towns but which could be brought in to help in the emergency. The effect of these high costs must be reflected in the rents of new houses, but before discussing rents I want to ask you to bear in mind a few facts which are apt to be put aside or forgotten. In the first place, a large number of agricultural labourers, say, 300,000 to 400,000, do not live in tied houses, and large numbers of these are

paying more in semi-suburban districts than the customary rural rent.

This brings me to the maximum deduction from wages which may be allowed for a tied house. Under the present system, are you going to get equal treatment as between the municipal and landowner builder? Can you say to the former that 7s. is a fair rent, but to the landowner that he can only charge 3s. for a similar adjacent house? That will have to be faced. Or, further, are you going to say to the local authorities that they should charge a different rent for similar houses, according to the occupation of the tenant? Local authorities will have to provide houses for agricultural, industrial, rural and semi-urban workers. Are they to charge the same rent to each class or are they to vary it according to the occupation of the tenant? They obviously could not limit their rents in semi-urban areas to 3s. weekly; but it is in fact clear that the rent of new houses must be much above the pre-war level. At the present moment agricultural labourers working on the same farm are often receiving different cash wages because they are charged a different rent, and as the deduction or payment for rent differs so the actual cash left to the labourer varies. Again, if more cottages had been available before the War they would in many instances have been let to agricultural labourers at more than 3s. rental. Lastly, if policemen, postmen, and other rural workers, are going to live in these new houses, the older and cheaper cottages will be available for the agricultural workers at a lower rental, although I do not want to limit agricultural labourers to these houses. We may, I think, safely say then that 3s. was neither the universal nor the maximum rent paid by the agricultural labourer before the War. Further, we cannot draw a strict line of demarcation between the various classes of occupiers of rural cottages when fixing rents for a group of identical houses.

I now want to say a word with reference to uneconomic rents. Let us take, for example, three labourers each paying an uneconomic rent. The first takes a tied house from the employer. In this case the employer is in fact paying a part of his rent. The man gets a larger wage than is apparent from the amount of his weekly earnings. The second labourer gets his house from the landowner. He is in this case subsidised by the landowner. The third labourer is the new type of case where the agricultural labourer rents his cottage from the local authority. If the landowner is able to point to a considerable

number of empty municipal cottages in a village near his land which are to be let at an uneconomic rent, either he is able to let his farm at a comparatively high rent without having to put capital into it by building cottages, as he had to build stables, byres, etc., or the farmer is relieved of the necessity of paying a sufficient wage to the workers to enable them to pay an economic rent. Here, if he gets an uneconomically rented house, it is the taxpayer and the ratepayer who are subsidising the labourer. It is important to notice this distinction. In cases (1) and (2) it is the private individual who is concerned. In case (3) it is the public. Whatever arguments there may be in favour of the farmer or the land-owner subsidising wages in the form of reduced rents, there can be no argument for the public doing so.

We are, therefore, faced with this fact, that all agricultural rents, where the houses are in good condition and have good accommodation, must go up, and, together with the initial rents for new houses built by local authorities, must be much higher than the figure customary in pre-war days. Reference to Note C below will show the sort of minimum rent which will have to be charged at the beginning if we are to get an economic rent later. On cottages costing £525 to £750, which are probably low figures, and assuming that one-third of the cost will be wiped off by the State grant, the economic rent to be charged later will vary up from at least 10s. to 15s. The cost is abnormally high now and I am afraid that we shall never get to pre-war costs, but I hope that when we arrive at the normal post-war conditions the present cost will have dropped by about one-third. This should be in about six or seven years. Meanwhile the Government will wipe off one-third of the present cost of building. That will be the contribution of the Treasury to meet the situation created by the War. That leaves the actual minimum figure on which an economic rent must be obtained as from £375 to £500, so that a rent of 10s. 8d. to 15s. 5d. per week, is the lowest economic rent to be hoped for in 1927 when we have normal conditions.

A fixed minimum of 7s. has been suggested as an initial rent for new rural cottages, but war experience has shown that a minimum tends to become a maximum, and such a low figure would be quite inadequate for industrial or semi-industrial districts. This is a serious objection to a cast-iron minimum which seems quite reasonable in itself.

The Government ideal is to arrive, later, at an economic rent, based on the cost of building in 1927, when they hope we shall have arrived at the post-war normal conditions, and when costs may have fallen by 30 per cent. Post-war rents must be a great deal higher than pre-war, and it is absolutely necessary to reconsider the figure of 3s. which is at present the maximum rent for a tied cottage. It will be impossible to say to local authorities that they should charge 7s. rent, and at the same time say to the private builder that he may only charge 3s. for an identical cottage in the same area. We must bear in mind the necessity for other houses in rural areas than those for agricultural workers, and we must consider the difficulty which local authorities would experience in attempting to let houses in the same area at different rents. In pre-war days the agricultural labourer would, in many cases, have been prepared to pay a higher rent for a better cottage. While the cost of living has doubled, agricultural wages have more than doubled. On the information available I do not think it would be unfair to say that the initial rent for an agricultural cottage should be at least 7s. to 10s. By this I do not mean that it is desirable that the rent of all the old cottages, many of which are far below our present standard, should go up to the same figure as for good new cottages. In 1927 it will be necessary to arrive at a very substantial increase and so in all probability there should be an intermediate rise on the proposed initial rents, say in about two or three years' time. The fact is that we must put rural housing on a commercial footing as soon as possible and get away from anything savouring of charity or subsidy. No industry can really exist without being placed upon a sound economic basis, and if the rural exodus and agricultural depression are to be checked we must get on to that basis as soon as possible.

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Note A.—It is estimated that about 1,000,000 rural houses are occupied by the working classes, of which possibly 60 to 70 per cent., i.e., 600,000 to 700,000, were occupied by persons solely employed in agriculture, and their families.

Need for New Cottages.—In 1913 the Land Inquiry estimated that 1,200,000 rural houses were occupied by working classes, and that an addition of 10 per cent. was needed to meet immediate housing requirements.

The Land Agents' Society regarded both these figures as over-estimates, and considered that 60,000 new cottages would be sufficient for agricultural workers.

Taking the middle of 90,000 between these two estimates and adding a further 10,000 for the increased need due to the cessation of building during the War, 100,000 might be taken as the present minimum requirement.

The Ministry of Health estimated that 500,000 new cottages were needed in the whole country. The population of rural areas is roughly one-fifth that of the whole country, so that on the basis of population the same figure of 100,000 would be indicated.

Tied Houses.—One-half to one-third of agricultural labourers inhabit tied houses (Land Inquiry).

So about 200,000 to 300,000 live in tied houses, and about 300,000 to 400,000 live in non-tied houses.

Possibly 75 per cent. of the tied houses are let at 3s. and 25 per cent. at 2s. 6d. or under. This is only a rough guess.

Note B.—The following counties had upwards of 30 per cent. of the male inhabitants engaged in agriculture in 1911:—

Montgomeryshire.	Anglesey.
Radnorshire.	Norfolk.
Huntingdonshire.	Pembroke.
Cambridgeshire.	Dorsetshire.
Lincolnshire.	Westmorland.
Herefordshire.	Oxfordshire.
Cardiganshire.	Wiltshire.
Suffolk.	Rutlandshire.

The proportion of the population overcrowded in the rural areas of these counties ranged in 1911 from 3 per cent. to 9·3 per cent., and, except in the case of Huntingdon, Westmorland and Rutland, was greater than the proportion overcrowded in the urban areas of the same counties, which varied from 1·9 per cent. to 6·2 per cent.

In all rural areas of England and Wales 61,000 tenements had more than two occupants per room, and half a million people were affected; roughly 6 per cent. of the population of rural areas.

Thirty-six per cent. of the population of rural areas lived over one but not over two per room.

N.B.—The term “overcrowded,” as used for the sake of convenience, refers to families in which more than two persons on an average occupy each room, including all living rooms. It does not allow for differences in the size of rooms or represent any opinion as to what does or does not constitute overcrowding, which must, of course, depend on a variety of other factors, such as the age and sex of the occupants.

Note C.—The cost of building, in town and country, is tending to approximate. A brick cottage of the type frequently

erected before the War, costing £350, would now cost at least £700. But local factors, such as the accessibility of materials, the nature of the site, etc., as well as the accommodation provided, affect the actual price.

There are some new methods of construction and some very old ones which appear to offer hopes of reduction in cost. *Fisé de terre*, cob and chalk may be suitable for some areas. Particulars of cost are not yet available, but it is thought that they should be substantially below brick.

Timber offers some advantages in speed of construction and price.

At the other end of the scale a number of quite new types of construction in concrete and steel, and concrete have been approved by the Ministry of Health. Some of these houses are capable of being produced in large numbers and rapidly erected. In many districts an economy of about £150 may be possible by use of these methods instead of brick.

Under the Housing (Additional Powers) Act just passed a subsidy of £150 will be paid to landowners, farmers or others erecting houses within 12 months for the working classes under certain simple conditions. In the cases of cottages built by local authorities the State is prepared to permit their sale on a basis of two-thirds of the cost of erection, and in calculating rents is prepared to wipe off one-third of the present cost of erection.

The probable cost of a rural cottage with standard accommodation will range from £500 to £750, so that either for the purpose of sale or for calculating the economic rent the cost of erection may be estimated roughly at from £350 to £500.

Assuming that the State bears the loss on one-third of the present cost of building, the economic rent of cottages of which two-thirds of the building cost was—

£350	would be	10/8	per week	(total cost	£525)
£400	"	12/3	"	(	" £600)
£450	"	14/-	"	(	" £675)
£500	"	15/5	"	(	" £750)

taking the rate of interest at 6 per cent. and the usual allowances for repairs, etc., in each case.

Note D.—Wages and Rents.—The special investigators appointed by the Board of Agriculture and Fisheries reported in December, 1918, that the average cash wages of the ordinary agricultural labourer were 16s. 9d. in 1914; this figure nearly agreed with those estimated by the Central Land Association and the Rural League in 1912-13.

The lowest minimum rate fixed by the Agricultural Wages Board is now 36s. 6*d.*, and the highest 42s. 6*d.*, so that the average must be above 37s.

The rise in the cost of living of rural workers was investigated by a special Committee appointed by the Agricultural Wages Board. Their conclusions were based mainly on the comparison of standard budgets and they explain that they cannot be regarded as in any way final. Their view was that in January, 1919, the cost of living had about doubled.

Adopting a similar method the Sumner Committee, appointed to inquire into the cost of living of the working classes generally, adopted a somewhat lower figure for June, 1918.

Without attaching to these figures a scientific accuracy which they do not claim, it may fairly be assumed that they are very near the truth and that, in fact, the cost of living of rural workers has roughly doubled since the outbreak of war.

During the same period rents have remained practically unchanged. The average shown by the Agricultural Wages Board Committee was 2s. 1*d.* in 1918, as compared with 1s. 11*d.* in 1914.

It appears to be difficult to resist the conclusion that the ordinary agricultural labourer, after meeting the increased cost of living, has more than the pre-war margin of cash to spend on rent. This is, of course, not an argument against the increase of wages that has taken place or against a further increase. The intention of the Corn Production Act was to give the labourer an increased standard of comfort. The first addition to his comfort that he needs is better housing; if the rise in the rate of wages has enabled him to pay a higher rent for a better house, it has achieved part of its purpose. It is agreed that the only permanent solution of the agricultural housing problem lies in the payment of an economic rent and in such wages as will make that payment possible.

SWEDÉS, TURNIPS AND MANGOLDS AT COCKLE PARK.

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VARIETIES OF SWEDES AND TURNIPS: THEIR COMPARATIVE VALUES.

THE county of Northumberland has taken an important place in the development of the culture of swedes and turnips in the north of England. J. Bailey and George Culley, in their work on the "Agriculture of Northumberland" (3rd edition, 1808), give a good account of turnip cultivation in the county at that time. They state that turnips were first grown for cattle feeding at Rock, near Alnwick, about 1730, and that their growth for this purpose quickly spread in the Lesbury district. The hoeing of this crop was first performed by skilled men of the gardening class, who received high wages, but the ordinary farm hands, including women, soon became quite good at this work. Craig of Arbigland, Dumfriesshire, drilled turnips in 1745, and in 1764 Dawson grew 100 acres drilled in ridges near Kelso. Matthew and George Culley migrated from Gainford, near Darlington, to Fenton, in Glendale, in 1767. George Culley, on his way from Fenton to a fair at Kelso, in that year first saw a field of drilled turnips, and was greatly impressed with the successful growth of this crop. The brothers Culley took Wark farm of 1,200 acres in 1786 at an annual rent of £800. This they cultivated with such marked success that as a result of their work and of increased prices the rent of this farm was increased to £3,200 in 1812. They and other pioneers developed the practice of drill husbandry in the cultivation of turnips. The raised turnip drill soon became known. Drilling was done much in the same manner as now, and the dung was enclosed in the drills. At first the drills were made 3 ft. wide, but it was soon found better to make them a width of only 2½ ft. or rather less. The practice now in the north is to sow turnips on raised drills, about 27 in. wide. The cultivation of turnips for sheep and cattle feeding quickly developed. About 1755-80 the Swedish turnip was introduced into Scotland from Gothenburg, where they were known as "ruta бага" The Culleys and others took up their cultivation. It is interesting to note that they are still called "bagies" on Tweedside. By 1804 swedes were in general cultivation in the north of Northumberland. George Culley made careful

tests with rams and ewes of the comparative feeding values of turnips and swedes, and found that swedes had a considerably greater feeding value than turnips, that sheep required a much larger quantity of turnips than of swedes, and that swedes kept much better till the late winter and spring. An excellent account of the development of root growing in Northumberland is given by John Grey of Dilston, in the *Journal of the Royal Agricultural Society* for 1841.

For some years, trials designed to test the comparative values of different varieties of swedes and turnips have formed an important section of the field experiments carried out at Cockle Park, the Northumberland County Agricultural Experiment Station. The main object of the trials has been to compare the value of varieties on the basis of dry matter content of the crop, but the opportunity has also been taken to test variations in local cultural practice.

Before describing the experiments in detail it should be pointed out that the varieties of roots tested **were classified** as swedes, turnips, and soft turnips, the old term "yellow turnip" being discarded on the ground that several yellow turnips contain as much water as white or soft turnips, and should, therefore, be included under that heading.

The method of procedure adopted in carrying out the experiments was as follows: On a portion of the land set aside for the root crop two drills of each variety are sown at the rate of 3-4 lb. of seed per acre in the case of swedes, and $2\frac{1}{2}$ -3 lb. in the case of turnips. The swedes and turnips are all sown on the same date and the soft turnips later, but also all on the same day. The turnip seed is steeped in paraffin or turpentine for about 2 hours before sowing, with the object of keeping the fly from the seedlings for a short time after germination. The seed is dried in the sun or otherwise before sowing. Up to 1917 good farmyard manure was applied at the rate of 12 tons per acre, and since that year at the rate of 15 tons per acre. After being carefully topped and tailed the roots are weighed and samples are taken, 100 roots from each variety being cored at an angle of 45° . The cores from each variety are wrapped in waxed paper and sent to Armstrong College, where they are carefully analysed. The sampling and analytical work has been conducted with great care by Mr. S. H. Collins, M.Sc.

Time of Sowing Swedes and Turnips.—During the seven years 1907-13, the average date of sowing the swedes and turnips was 24th May, and during the four years 1915-18, 13th May.

It is interesting to note that the average dry matter per acre in the swede crops was 3·10 tons in the last four years, when earlier sowing was practised, as compared with only 2·29 tons in the first seven years. It should be mentioned, however, that in the later years the larger crops were to some extent due to an improvement in soil conditions. There is a tradition in the northern counties that swedes should not be sown later than about the middle of May, and this is certainly borne out by the results obtained at Cockle Park. It is not desirable to commence sowing swedes earlier than the last few days of April, as it has been shown at Cockle Park that a large proportion of the swedes sown early in that month "bolt" or "run to seed," probably because their growth in the early stages is interrupted by frost. On the other hand a careful study of the tables in the following pages will show the advantages of completing the sowing of swedes not later than the middle of May. If this is impossible it is then probably advantageous to substitute turnips for swedes. The tables conclusively show that swedes sown early will produce considerably more feeding material per acre than turnips sown at the same time, but that when swedes are sown late the feeding value of the turnips sown at the same time is equal, if not superior, to that of the swedes.

It has been the practice for the last two years at Cockle Park to plough the land for roots as deeply as possible in the previous autumn or early winter, and not to plough again in spring, but to complete the preparation by cultivation. This ensures that full advantage is taken of the good tilth resulting from the effect of the winter frosts, and a much better seed bed is obtained for the very small seeds of these crops, which are thus given a good start.

The soft turnips are usually not sown till some time in June. The object of including soft turnips in the trials is to enable farmers to judge how different varieties of these compare with each other. They are, of course, sown only on land on which it has been impossible to get swedes or turnips sown in good time.

It should be noted that the times of sowing apply to the northern counties. In the southern counties of England swedes are sown considerably later than in the north for reasons that need not be stated here.

Trials of Swedes and Turnips at East Leamouth, Berwick-on-Tweed.—In 1913 Messrs. Sutton & Sons, Reading, tested a very large number of swedes and turnips on Mr. Wm. Davidson's

farm at East Learmouth. Mr. Davidson arranged for all the varieties to be grown under exactly the same conditions, and on 12th November a large party of agriculturists inspected the trials. As one of the party the writer noted the good results given by the following swedes.—Caledonian (bronze top); Up-to-Date (bronze top); Champion (purple top); and Magnum Bonum (purple top). The appearance and apparent hardness of the Caledonian swede, which was then quite a new variety, were especially noteworthy, while the Favourite (purple top) Aberdeen turnip also attracted attention. It was decided to include all these varieties in the trials at Cockle Park, together with Early Sheepfold and Selected Fosterton, both green top yellow turnips which had also made good growth. It will be seen from the results given in the tables that the two last-mentioned varieties should be included among the soft turnips and not among the ordinary varieties.

It is satisfactory to note that in 1919 Mr. William Davidson obtained the £100 Victory Cup offered by Messrs. Sutton & Sons for the heaviest yield of swedes in the United Kingdom. The winning variety was Caledonian, which was found to weigh 58 tons an acre, this being 13 tons heavier than the crop of the next competitor. It will be seen from the tables that Caledonian swede has given the largest amount of feeding material per acre at Cockle Park in the years it has been tested.

Average Percentage of Dry Matter in Swedes.—The tests made from 1901–1919 gave an average result of about 12 per cent. dry matter in swedes. The amount varied from 10·32 per cent. in 1901 to 14·90 per cent. in 1904. This means that 20 cwt. of swedes in 1904 were about equal in feeding value to 29 cwt. in 1901. In summers when frosts occur on the grass at Cockle Park there are indications that the swedes are likely to be lower in dry matter than when such frosts are not prevalent.

The average amounts of dry matter in turnips and soft turnips are given in the tables.

TABLE I.—VARIETIES OF SWEDES AND TURNIPS, 1915–18.

Results per Acre.

	<i>Weight of Roots. Tons cwt.</i>		<i>Percentage of Dry Matter.</i>	<i>Weight of Dry Matter. Tons.</i>
Swedes—				
Average for eight varieties (4 years) ..	26	2½	12·05	3·10
Turnips—				
Average for five varieties (4 years) ..	26	19	9·95	2·67
Soft Turnips (1915 and 1916)—				
Average for five varieties (2 years) ..	25	12	8·46	2·19

TABLE II.—VARIETIES OF SWEDES AND TURNIPS, 1915-18.

Average Results per Acre for Four Years.*

<i>Variety.</i>	<i>Weight of Roots. Tons cwt.</i>	<i>Percentage of Dry Matter.</i>	<i>Weight of Dry Matter. Tons.</i>
SweDES—			
Darlington (bronze top)	24 15	12'40	3'05
Improved (bronze top)	26 8½	12'03	3'16
Caledonian (bronze top)	27 7½	12'34	3'36
Up-to-date (bronze top)	26 19½	11'83	3'17
Champion (purple top)	24 18½	12'15	3'01
Magnum Bonum (purple top)	26 6	11'65	3'03
New Buffalo (purple top)	25 1	12'02	3'06
Conqueror (bronze green top)	26 14½	11'97	2'94
Turnips—			
Green Top Aberdeen	24 10½	10'50	2'59
Perfection Green Top Aberdeen	25 5	10'08	2'55
Large Improved Green Top	29 4½	9'35	2'70
Purple Top Aberdeen	26 4½	10'01	2'63
Favourite Purple Top Aberdeen	29 10	9'78	2'89
Soft Turnips (1915 and 1916)—			
Early Sheepfold (green top yellow)	21 6½	8'92	1'89
Selected Fosterton (green top yellow)	25 17½	9'15	2'54
Centenary (green top yellow)	26 12	7'68	2'03
Purple Top Mammoth (white)	28 3½	8'23	2'30
Pomeranian White Globe	26 0½	8'32	2'19

* Soft turnips only two years' average.

TABLE III.—VARIETIES OF SWEDES AND TURNIPS, 1907-13.

Average Results per Acre for Seven Years.

<i>Variety.</i>	<i>Weight of Roots. Tons cwt.</i>	<i>Percentage of Dry Matter.</i>	<i>Weight of Dry Matter. Tons.</i>
SweDES—			
Average for four varieties (7 years)	19 5½	11'90	2'29
Turnips—			
Average for six varieties (7 years)	24 18½	9'29	2'31
Soft Turnips—			
Average for three varieties (7 years)	21 8½	8'04	1'72

TABLE IV.—VARIETIES OF SWEDES AND TURNIPS, 1907-13.

Average Results per Acre for Seven Years.

<i>Variety.</i>	<i>Weight of Roots. Tons cwt.</i>	<i>Percentage of Dry Matter.</i>	<i>Weight of Dry Matter. Tons.</i>
SweDES—			
Darlington (bronze top)	19 16½	11'75	2'33
Improved (bronze top)	19 8½	11'95	2'33
Crimson King (purple top)	19 8½	11'81	2'30
Holborn Kangaroo (bronze top)	18 10	12'09	2'24
Yellow Turnips—			
Dale's Green Top	25 11½	8'90	2'28
All the Year Round	26 19½	8'52	2'30
Purple Top Aberdeen	24 19½	9'61	2'40
Green Top Aberdeen	22 19½	9'97	2'29
Mikado	24 8	9'29	2'26
Large Improved	24 13	9'44	2'33
Soft Turnips—			
Purple Top Mammoth	22 7½	8'04	1'80
Red Paragon	18 18	8'10	1'53
Centenary	22 19½	7'98	1'83

Summary of Results.—(1) When swedes and turnips are sown at the same time, between the end of April and the middle of May, the weight of dry matter in the resulting crop of turnips is 86 when that in the swede crop is taken as 100 (Tables I. and II.) When, however, swedes and turnips are sown under the same conditions later than the middle of May, this advantage for swedes disappears (Tables III. and IV.) Soft turnips are not sown till after it is too late to sow swedes and turnips. In respect of those sown at Cockle Park during June the figure for dry matter is 71, as compared with 100 for swedes sown in good time.

(2) The results of many feeding tests carried out at Cockle Park show that for cattle and sheep feeding the dry matter of swedes and turnips, and of different varieties of each, has practically an equal value. The relative food values of the various swedes, turnips, and soft turnips tested can, therefore, be judged from the dry matter figures given in the tables. Special attention is drawn to Table II., from which it will be seen that Caledonian (bronze top) swede has produced considerably more dry matter per acre than any of the other swedes; and that Favourite purple top Aberdeen turnip is highest in this respect among turnips. The results from these two varieties are not only the average best of the four years, but are also the best in respect of each of the four years.

(3) Throughout the trials the average percentages of dry matter were approximately as follows:—Swedes 12 per cent., turnips 9.6 per cent., soft turnips 8.25 per cent. This means that 20 cwt. of swedes, 25 cwt. of turnips, and 29 cwt. of soft turnips have practically the same feeding value.

(4) Three yellow turnips, Early Sheepfold, Selected Fosterton and Centenary, have yellow flesh of the same kind as ordinary turnips, but owing to their low content of dry matter they are grouped with soft turnips. It is believed that many farmers grow these varieties under the impression that they have the same feeding value ton for ton as ordinary turnips. It should be clearly understood that this is not so.

(5) The trials have shown that singling swedes 8 in. apart has given the heaviest crops, and that the drills should be kept as narrow as will permit of good cultivation during the growth of the crop. At Cockle Park the drills are usually 27 in. wide.

(6) The fact that the crops grown in the four years, 1915–18, were heavier than in the 7 years, 1907–13, is partly due to the

improvement of soil conditions brought about by the judicious growing of wild white clover and the application of basic slag.

(7) The varieties tested constitute only a few of those now on the market, but it is hoped that the results given will be helpful to farmers in making a suitable selection. It should be borne in mind, however, that the suitability of different varieties varies with soil and climate as well as other conditions.

(8) Attention is specially drawn to the figures in the tables giving the amounts of dry matter per acre produced by the different varieties. These figures are the truest indication of the value of a root crop to the farmer.

HOW MANGOLDS COMPARE WITH SWEDES AND TURNIPS.

Long-continued trials at Cockle Park show that mangolds do not mature so well in the northern as in the southern counties. They also indicate that the manuring for this crop must be much more liberal than that for swedes and turnips. At Cockle Park the seed is sown in drills 27 in. wide at the rate of 8 to 10 lb. per acre. It is previously steeped in water for 24 hours and then spread in the sun to dry before sowing; this practice hastens germination. The crop is usually sown between 21st April and 8th May. Earlier sowing gives an undue proportion of "bolted" plants, and later sowing is too late in the north for this crop. A considerable proportion of plants bolt, but it is better to allow this to happen than to run the risk of having a much smaller crop from late sowing. Mangolds have been grown year after year on the same land at Cockle Park, but quite good results have been obtained by growing them in rotation, alongside other roots. For the 3 years, 1917-19, about 27½ tons per acre of Prizewinner Yellow Globe mangolds have been produced. The average amount of dry matter contained in the crop was about 11 per cent., or about 3.02 tons per acre. This is approximately equal to the average content of swedes over the 4 years, 1915-18.

The following manuring per acre gave excellent results in these years: 12 tons dung, 2 cwt. sulphate of ammonia, 3 cwt. high-grade basic slag, and 2 cwt. common salt. The dung is spread in the drills, and all the artificials are applied on the top before the drills are split.

Mammoth Long Red mangolds have also been grown at Cockle Park. These have given about the same weight of roots per acre, but they have a higher dry-matter content (viz., 12.9 per cent.) than Prizewinner Yellow Globe mangolds, and have consequently produced considerably more dry matter

per acre. Long Red mangolds, however, are more difficult to remove from the ground, owing to the greater depth of the roots.

About 1½ acres of mangolds are grown annually at Cockle Park, and are found of great value for ewes and lambs during the months of April and May. While mangolds are not quite so suitable for our northern climate as are swedes and turnips, their value for the purpose indicated and their keeping properties make them a very useful crop when a small area can be grown successfully.

Mr. H. C. Pawson has given much help in the preparation of this report.

INCUBATING STATIONS.

THE five Breeding or " Incubating " Stations which form part of the Ministry's Scheme for the Improvement of Poultry Stock were established in 1916 or 1917,* and the time has now arrived, therefore, when it is possible to review with advantage the results which have been obtained. The sites for the Stations were selected in the following counties :—

Anglesey, at Lledwigan, near Llangefni.

Carnarvon, at Madryn Castle Farm School, near Pwllheli.

Denbigh, at Lleweni Hall, Denbigh.

Cheshire, at Henhull Hall, Nantwich.

Cornwall, at Kernock, St. Mellion.

The main purpose of the Stations has been to distribute day-old chickens to small holders and cottagers, and, in addition, to supply applicants with sittings of eggs and stock birds from any surplus not required at the Station. Consistent with rendering the Station self-supporting the price of stock was fixed as low as possible, so as to encourage applications from poultry keepers who were unable to appreciate the value of better quality poultry.

The sites chosen were in districts in which this work would be likely to meet the greatest need and where facilities existed which allowed an economical arrangement to be made.

The Stations were placed under the supervision of the County Council Authorities, to whom a grant was made annually for the employment of an official to take charge of the work and to make any special arrangement which might be necessary

* Particulars of the Scheme and of the Incubating Stations were published in this *Journal*, April, 1916, p. 72, and October, 1916, pp. 685 and 702, and an account of the working of the scheme during 1917-18 in the issue for December, 1918, p. 1106.

as the work was developed. The management has been undertaken by women, who have proved themselves very capable in carrying out the work and especially in meeting many of the difficulties experienced in the early stages.

As the establishment of these Stations was of an experimental nature, the equipment provided was on a limited scale. Much of it, moreover, had already been previously utilised at other Centres for experimental purposes, and although adaptable for the purpose it was not the best type which could have been selected for the work.

The stock purchased for the Stations was from the very best laying strains, and the breeding pens were carefully mated. An important part of the Station work was to trap-nest the birds reared annually, in order to improve or maintain the quality of the stock at the Stations by selective breeding. The breeds chosen, White Wyandotte and White Leghorn, were considered the most suitable for general requirements, and only at one Station (Denbigh) was a third variety kept, *viz.*, Rhode Island Red.

Each Station consists of from two to three acres of land and the necessary buildings. From 80 to 100 adult birds are maintained for breeding purposes. These are penned in large grass runs each containing 10 or 12 hens and a male bird. A scratching-shed house fitted with trap-nests is provided for each run.

One half to two-thirds of the stock consists of pullets. Only the very best hens for breeding are retained after trap-nesting, and it has therefore been necessary to use the pullet stock for breeding. The stock hatched for retention, however, are from the more mature, tested birds, and the eggs and chicks distributed have, in the first instance, always been selected from the best pens.

Hatching has been carried out with small incubators with a total capacity at each Station of 600-800 eggs. Each year between 200 and 300 chickens are hatched and reared to provide stock for the Station, and from 800 to 1,200 day-old chickens for distribution in small lots to poultry keepers.

General Management.—The manageresses were single-handed until 1919, when the training of an assistant was in two cases undertaken. The work is responsible and exacting, entailing a considerable amount of advisory work, in addition to the entire manual work, management, and correspondence.

The success of the Station rests to a very large extent with the manageress, whose qualification must be of a specially high



FIG. 1.—A section of the Breeding Pens, Anglesey Station. The pen is occupied by young cockerels, while the breeding stock are on the stubbles.



FIG. 2.— Wyandotte and Leghorn Pullets, Anglesey Station.



FIG. 3.—The Rearing Ground and a corner of the Oat Stubbles, Anglesey Incubating Station.

order, since the methods employed are taken as a pattern for guidance to small poultry keepers in the county, and advice is sought by visitors and by correspondents on all matters relating to poultry.

Fresh male birds are introduced annually. Trap-nesting is carried out for six months in most cases, and has at times been continued for twelve months with special birds. The Station stock are hatched in March and April. The distribution of chickens commences in February and ends on or about 31st May. Sittings are distributed throughout the season and stock birds between June and October.

The food of the adult birds has in every instance consisted of wet mash and grain. In one case dry mash to supplement this food was used in addition, and the results were particularly good in this instance from the point of view of egg production.

Meat meal, or fish meal has been used in limited amounts, but no spice is given. Food is obtained through the ordinary channels and at no time have the Stations had any special advantage in this respect over other poultry keepers in the district.

Surplus eggs and birds fit only for table purposes have been disposed of in the local markets.

Anglesey Station.—The site at Lledwigan, at which the work was started in 1916, was unsuitable for a permanent Station, and the stock was transferred to a complete holding of 2½ acres with a cottage within a mile and a half of the market town of Llangefni. Incubator and food rooms were added to the cottage.

The holding is very exposed to the heavy gales to which the Island is subject. The breeding pens occupy about three-quarters of an acre of ground, three-quarters of an acre is left for rearing in the spring and summer, and one acre is sown down to crops. Very good crops of oats have been obtained from this land in the last two years, and after harvest the birds have been turned out on to the ground.

The records of the birds—some of which have been published*—have been exceedingly good under the local conditions. Wyandottes have done better than the Leghorns, and it was at one time under consideration whether the latter breed should be dropped; a small proportion of Leghorns has been retained in the stock, however, as the demand for them is as large as for the Wyandottes, and the vigour of the stock should make them valuable under less severe conditions.

* See this *Journal*, December, 1918, p. 1106.

So keen is the demand for chicks and stock birds that although the supply to each applicant is strictly limited, applications for the whole of the output could be booked twelve months in advance.

The success of this Station has, without doubt, been due largely to the capable management of Miss Stanton, the manageress, and to the interest shown in her work by, and the practical support which she has received from, the Agricultural Organiser. Numbers of visitors call at the Station for advice, and there is much evidence of the value of the assistance given in the work which is being done in the county.

The produce disposed of from this Station in the four years since its formation in 1916 has been as follows :—

<i>Eggs for Hatching.</i>	<i>Chicks.</i>	<i>Stock Birds.</i>	<i>Produce for Table.</i>
1,824 ..	4,763 ..	461 ..	£157 7s. 3d. (3 years' figures.)

The normal capacity of the Stations can be reckoned only at 1,200 chicks and 100 stock birds annually for distribution.

Carnarvon Station.—This Station was unsuccessful, and the work was discontinued the second season.

Denbigh Station.—This Station was started at Lleweni Hall in 1917, two acres of land being given up to the poultry. At first the birds were all penned, but during late summer and autumn many of the birds were placed on free range on the farm. The land was very wet and the site badly placed for demonstration purposes and the despatch of produce. Very good work was done in 1918, but at the conclusion of the season it was deemed advisable to move to another site.

This Station is now situated a mile from Denbigh on a holding of three acres of very suitable land. A small cottage has been rented to provide an incubation room and office accommodation. Owing to the removal of the Station and the illness of the manageress, who eventually had to resign owing to ill health, little could be done in the way of distribution this year (1919), but the Station is in a good condition for work during the coming season.

Cheshire.—At this Station the poultry occupy less than 2 acres of ground enclosed with netting, and although located on a farm of 400 acres these advantages are of little value in the placing of the birds on free range, owing to the risk of losses from foxes.

The land is very wet, with a heavy soil, and although the pens have been moved to a fresh site, the conditions are not

good. Nevertheless, the records of the birds this season have been exceedingly good, and over 1,300 chickens and 85 adult birds have been distributed.

The stock raised during the year has proved vigorous, and the mortality has been very low. Careful records have been kept of the pedigree of the birds retained, and the Station is in a very good condition, owing very largely to the capable and thorough way the work is being carried out by the manageress, Miss Philipsen.

Cornwall.—At the commencement of the work the Station was under the great disadvantage of being seven miles from the railway and with no facilities for demonstration work. Excellent work was done at Kernock for two years, but in the latter part of 1918 the equipment was moved to Truro.

A field of $2\frac{1}{2}$ acres near the County Hall was rented for the purpose, and although to a certain extent the removal has meant a fresh start, with the usual disadvantages attendant on removals, the work has gone steadily on under the same manageress. 1,120 day old chickens, 1,674 eggs for hatching and 40 stock birds have been distributed from the Station during 1919. The present position of the Station is very suitable for demonstration work, of which advantage is being taken, and Miss Watson, the manageress, has been able to extend the value of her work by visiting and giving practical lectures in the county. Miss Watson is now training an assistant in the work.

Useful evidence of the value of the stock is given by the trap-nest records, which show the averages for the flocks for the first six months of the year (commencing immediately after removal) as follows:—

Average for Leghorns (6 months) 134·2 eggs per bird.

„ Wyandottes (6 months) 116·4 „

The laying of the Leghorns was very consistent; the lowest score in the six months was 123, and only six birds failed to lay 130 eggs.

A drawback to the establishment of a complete holding for poultry on a small scale, such as is the case with these Incubating Stations, is the difficulty of finding holdings possessing suitable buildings. A substantial building is needed for incubation purposes, and good accommodation must be provided for the storage of food; the initial expense is, therefore, proportionately high.

Although these Stations have efficiently demonstrated the possibilities and methods of managing poultry on a small

holding where the necessary buildings exist, it would be a distinct advantage if they could be carried on in connection with a Farm Institute, where there would be better facilities for demonstration work, and the Station could be run more economically.

TITHE RENTCHARGE.

Redemption by an Annuity.—The Tithe Act, 1918, gave landowners who desire to redeem the tithe rentcharge on their land the option of paying the consideration either in cash or, under certain conditions, by means of an annuity. The amount of the annuity has to be calculated in the following manner. To interest not exceeding 5 per cent. per annum on the consideration money is to be added such sum as would be sufficient, if the periodical payments thereof were accumulated at compound interest at a rate not exceeding 4 per cent. per annum, to produce an amount equal to the consideration money at the end of the said period. The total of these two sums will give the amount of the yearly or half-yearly payment of the annuity as the case may be. In an average case the amount of the annuity for 50 years required under the Act to discharge the consideration for redemption of £100 tithe rentcharge, if attached to a benefice, would be about £104, and if not attached to a benefice, would be about £91. In this connection it may be noted that the sum payable under the Tithe Act, 1918, in respect of every £100 tithe rentcharge which becomes due on or before the 1st January, 1926 is £109 3s. 11d., and that after that date the sum payable is to vary from year to year in accordance with the average prices of wheat, barley and oats for the fifteen preceding years.

It is important to note that under the Tithe Act, 1918, the Minister's power to determine, on the sole application of the landowner, that the consideration for redemption shall be paid by an annuity, is limited to applications made on or before the 1st January, 1921. Henceforward the consent of the tithe owner to redemption by annuity, instead of by a cash payment, will also be necessary. Moreover, in some instances, landowners will doubtless find that their land forms part only of an area charged with tithe rentcharge, so that an altered apportionment will be necessary before an application for redemption can be lodged. In such cases application for altered apportionment

should be made forthwith. The proper forms and any instructions that may be necessary will be supplied, post free, on request to the Ministry at 3, St. James's Square, London, S.W. 1.

Compulsory Redemption.—When the tithes in kind were commuted into tithe rentcharge under the Tithe Act, 1836, and the amending Acts, a tithe rentcharge was in some parishes charged upon each field and in other parishes upon each farm. Since the commutation, however, lands in many parishes have become minutely sub-divided in ownership, either for building or other purposes, and in such cases the tithe owner has the right to call upon the owner of any part of the original field or farm as shown on the tithe map to pay the whole tithe rentcharge, leaving him the extremely difficult and expensive task of recovering from each of the other property owners concerned a due contribution towards the amount so paid. The most satisfactory course open to the property owner thus called upon to pay the entire rentcharge is to apply to the Minister for its compulsory redemption. The Minister assesses the total cost of redemption, including the redemption money and the official fees, among all the properties comprised in the site of the original field or farm, and collects the assessments from the owners of such properties so that each property owner is required to pay a fair share and no more.

Tithe owners also have the right in such cases where the land is minutely sub-divided to apply to the Minister for the compulsory redemption of the tithe rentcharge. They are also entitled to apply to the Minister for the compulsory redemption of any tithe rentcharge not exceeding 20s. charged on fields which have not become sub-divided.

One series of compulsory redemption cases now in progress affects 4,500 property owners in the district of Aston-juxta-Birmingham. The schedules of assessment of redemption money and expenses and the plans will in due course be deposited in the locality for the statutory period and twenty-one days for inspection by all persons interested. Any objections to the schedules will require to be heard and determined under Section 39 of the Tithe Act, 1860. As is usual in proceedings of this character, most of the objections will doubtless emanate from property owners who have been fortunate enough to escape payment of the tithe rentcharge altogether, their shares having been paid by one of the owners in the original field of which their property forms part, as owner who has not thought it worth while to go to the trouble to recover contributions toward the payment made by him.

The fact that they have thus escaped payment does not, however, exempt them from their liability to contribute to the cost of redemption.

The Custody of Documents relating to Tithes.—Lands in 11,787 parishes in England and Wales are subject to tithe rentcharge. The amount of this charge on any particular property may be ascertained by inspecting the tithe map and apportionment for the parish in the custody of the Ministry. Certified copies of each map and apportionment have been deposited in the parish, usually in the custody of the Incumbent and Churchwardens. Copies are also to be found in charge of the Registrar of the Diocese. The parish or Diocesan copies are open to inspection on payment of a charge of 2s. 6d. According to complaints which reach the Ministry from time to time, many of the parish copies of the apportionments and maps are in a worn and damaged state, while others have been entirely lost. This is no doubt due, partly to the practice of some custodians of unlawfully lending the documents out of their custody and partly to collectors of the tithe rentcharges being permitted to keep the documents, even in cases where they reside and carry on business out of the parish. Should a sealed copy of a tithe map or apportionment be in the possession of a person other than the persons legally entitled to hold it, any two Justices of the Peace for the County, or other jurisdiction within which the lands are situate, may, upon the application of any person interested in the lands or rentcharge, order the document to be removed from the custody of the person who unlawfully holds it and to be deposited in such other custody as the Justices may think fit, having reference to the security and the preservation of the document and to the convenience of the parties interested therein. Another means of dealing with cases where documents of this character are in unlawful custody is afforded by Section 17 (8) of the Local Government Act, 1894, which provides that Parish Councils may give directions as to the custody in which statutory parish copies of tithe apportionments and maps and of other tithe documents shall be deposited. This Sub-section further provides that the Incumbent and the Churchwardens on the one part and the Parish Council on the other are entitled to reasonable access to the documents, and any difference as to the custody or access is to be determined by the County Council.

Apportionment.—Where an estate charged with one tithe rentcharge is broken up and sold off in lots, it is often provided in the conditions of sale that the respective

purchasers shall pay the tithe rentcharge in accordance with an informal apportionment of the rentcharge made in connection with the sale. Landowners cannot, however, bind the owner of the tithe rentcharge by any such arrangement, nor would the consent of the owner of the rentcharge be sufficient in all cases to make the informal apportionment binding on all persons who may be the successors in title to the land and the rentcharges respectively. Where an informal apportionment is made, disputes and litigation not infrequently arise, particularly in cases where the lots are further sub-divided and resold. As a rule, the only effectual mode of apportioning tithe rentcharge is by means of an altered apportionment issued by the Minister, and, except in a few special cases, this can be done only if a landowner is willing to initiate the proceedings. The landowners concerned in any proposed altered apportionment may jointly employ an agent for the purpose of preparing a draft altered apportionment, and arrange for the payment of his remuneration and of the official fees. Alternatively, the applicant may request the Ministry to prepare the draft and to collect the costs by means of a rate levied on the other landowners concerned in such proportions as appear to be equitable. There is a widespread belief that proceedings for altered apportionment are troublesome and expensive. As a matter of fact, in cases where the Ministry is requested to prepare the draft and assess the costs, all that is necessary is that the applicant should send in his application on the usual form, together with a plan showing the properties into which the original estate has been sub-divided, in which event the Ministry will do what is further necessary in the matter. In such cases the official fees work out on an average at about £18 per case, £1 per landowner, and 1s. 2d. per acre. The necessary forms of application and instructions may be obtained free of charge on request to the Ministry.

IMPORTS OF FOOD.

THE year 1919 may be regarded as transitional between the close of war conditions and the resettlement of trade on a peace foundation. Foreign and colonial markets are once more opening wider their doors to the British purchaser, and in the matter of food supplies the British farmer is again confronted with the prospect of increased competition from overseas. The returns relating to the agricultural imports and exports of the United Kingdom for the year 1919 contained in the Trade and Navigation Accounts recently issued by the Board of Trade* show the extent to which this trade has so far been able to recover as a result of the cessation of hostilities. The returns cannot, of course, be taken to represent the first year's working of trade under normal peace conditions. Trade restrictions and the enforcement of the German Blockade continued to some extent during the year, while as a special relief measure the Allied Governments made provision for supplies of food to be sent to meet the needs of starving Europe, which in times of more settled harvests might compete freely in international trading.

The total value of the principal articles of agricultural produce imported into the United Kingdom, as declared at the port of arrival, during the last seven years, was as follows:—

					£
1919	..	..	..	..	452,048,000
1918	..	..	..	..	423,822,000
1917	..	..	..	..	357,181,000
1916	..	..	..	..	305,493,000
1915	..	..	..	..	276,648,000
1914	..	..	..	..	211,591,000
1913	..	..	..	..	213,457,000

These figures represent the value of the grain and flour, meat and animals for food, butter, cheese, eggs, condensed milk, fruit and vegetables, hops, lard and margarine, which may be grouped together as agricultural products in the sense that they compete more or less directly with the products of the farmers of the United Kingdom.

The value of our imports during 1919 has thus increased 6.6 per cent. on the previous year, and 111.3 per cent. on 1913. While the figures for 1919 as to quantity may be said generally to show an increase over those for 1918, in a number of the main articles of import the increase is very small, while others show

* Obtainable from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, price 1s. 6d. net.

an appreciable decrease. Of the principal agricultural commodities, the imports in the total quantity of meat only increased 1·3 per cent.; wheat and barley increased respectively 23·3 and 231·2 per cent.; while oats decreased 38·9 per cent. Butter and cheese show slight decreases, but eggs increased substantially.

Total Imports of Meat.—The quantities and values of dead meat (excluding poultry and game) imported into this country during the last seven years were as follows:—

			Quantity.		Value.
			Cwt.		£
1919 .. ..	..	..	25,561,099	....	173,893,874
1918 .. ..	..	..	25,227,899	....	173,386,787
1917 .. ..	..	..	19,573,552	....	101,617,443
1916 .. ..	..	..	23,347,847	....	93,382,476
1915 .. ..	..	..	25,276,030	....	86,151,234
1914 .. ..	..	..	23,587,820	....	62,222,035
1913 .. ..	..	..	23,278,230	....	55,309,358

The details for the years 1919, 1918 and 1913 are shown in the following table:—

Imports of Dead Meat.

Description.	Quantities.			Value.		
	1919.	1918.	1913.	1919.	1918.	1913.
	cwt.	cwt.	cwt.	£	£	£
Beef, fresh and re-						
frigerated	6,492,120	7,588,784	9,203,310	30,632,644.	36,081,255	16,070,833.
Beef, salted	68,990	14,682	49,834	454,345	97,812	111,070
Mutton fresh and re-						
frigerated	4,074,956	2,086,148	5,330,290	17,987,556	9,273,646	10,907,992
Pork, fresh and re-						
frigerated	136,189	99,654	494,264	899,975	685,973	1,368,360
Pork, salted	24,065	11,691	240,597	175,588	77,511	297,135
Baron	8,280,923	10,473,562	4,857,590	73,584,300	90,381,595	17,428,881
Hams	1,813,376	1,554,943	854,995	16,091,677	13,028,626	3,068,251
Meat, unenumerated,						
fresh and refrigerated	1,121,880	690,620	728,329	5,543,197	3,322,004	1,429,997
Salted	15,512	2,623	104,138	105,430	14,165	188,409
Meat, preserved	3,261,749	2,188,650	889,005	27,742,740	19,218,168	3,707,054
Rabbits	271,339	516,542	523,578	701,422	1,206,033	781,376
Total	25,561,099	25,227,899	23,278,230	173,893,874	173,386,787	55,309,358
Poultry.—						
Alive	Number.	Number.	Number.			
619	101	858,979	386	96	37,923	
cwt.						
Dead	147,567	34,792	278,465	1,528,002	287,073	954,340
Game						
Alive	—	—	—	7,195	—	43,422
Dead	—	—	—	18,564	5,392	76,115

Beef.—No fresh beef has been imported since 1917.

Chilled Beef was imported in 1919 to the quantity of 125,504 cwt., as against 163,959 cwt. in the previous year, and 5,248,004 cwt. in 1913. With regard to value, the figures decreased from £771,137 in 1918 to £385,346 in 1919. The Argentine (123,804 cwt.) and Uruguay (1,700 cwt.) were the only countries of import; the respective figures for these countries in 1913 were 5,216,022 cwt. and 31,982 cwt., when they also between them supplied the whole of the chilled beef imported.

With regard to imports of *frozen beef*, imports decreased from 7,424,825 cwt. in 1918 to 6,366,616 cwt. in 1919 in quantity, and £35,310,118 to £30,047,298 in value. The quantity and value of frozen beef imported during 1913 were, respectively, 3,952,880 cwt. and £6,278,793. The countries whence the beef was consigned were as follows :—

			1919.		1918.	
			cwt.	£	cwt.	£
Argentina ..	..	..	3,743,914	17,587,450	1,852,807	8,541,522
United States ..	..	..	856,170	4,715,681	3,583,549	18,213,746
Australia ..	..	..	622,307	2,487,164	547,060	1,969,461
New Zealand ..	..	..	424,735	1,771,322	388,382	1,341,316
Uruguay ..	..	..	307,284	1,423,602	186,411	847,892

The imports from the Argentine have doubled, while those from the United States have decreased by 76 per cent. It may be remarked that in 1913 the Argentine sent us half of our imports of frozen beef, and Australia one-third; the quantity received from the United States was inappreciable.

Mutton.—No *fresh or chilled* mutton has been imported during the last two years. The imports of *frozen* mutton rose from 2,086,148 cwt. in 1918 to 4,074,956 cwt. in 1919, or nearly 100 per cent.; the pre-war figure (1913) was 5,204,257 cwt. Thus the return of peace conditions has shown a rapid recovery in imports, approaching to the quantity received before the War. The respective values for 1919, 1918, and 1913 were £17,957,556, £9,273,646, and £10,583,930.

Our supplies were received mainly from New Zealand, the Argentine, and Australia, which in 1913 were also the principal countries of import.

Pork.—No *fresh or chilled* pork has been imported during the last three years.

Frozen pork was imported in 1913 to the quantity of 15,707 cwt. (value £43,255), and *salted* pork 240,597 cwt. (value £297,135). It should be mentioned, also, that in pre-war years Great Britain imported a considerable quantity of fresh pork, chiefly from the Netherlands, the total for 1913 being 478,557 cwt. America exported to us the bulk of our supplies of frozen and salted pork, although before the War Denmark was, in the latter commodity, by far our principal supplier. During the past few years, however, no imports were obtained from that country.

Bacon, Hams.—It will be seen from the above table that the figures for bacon and hams show a considerable increase over those for 1913.

The bulk of our supplies, both of bacon and hams, came from the United States. In regard to bacon, out of the 8,280,923 cwt. imported, the United States consigned 5,893,514 cwt. and Canada 2,094,248 cwt.; Denmark, which in 1913 sent us nearly half our supplies, during the past two years has exported to the United Kingdom an almost negligible quantity. While the importation of hams has increased so considerably, there has been little change in the markets of supply, the United States, as always, having sent us by far the largest quantity, with Canada as the only other country of any importance in this trade.

Rabbits.—271,339 cwt. of dead rabbits were imported during 1919 of which 270,491 cwt. were frozen, and 848 cwt. fresh. In the previous year the quantity was 516,542 cwt., all of it frozen. The pre-war figure (1913) was 481,964 cwt. frozen, and 43,614 cwt. fresh. Practically the whole of our supplies of frozen rabbits, as before the War, was received from Australia.

DAIRY PRODUCE AND EGGS.

Imports of Dairy Produce, Margarine and Eggs.

Description.	Quantities.			Value.		
	1919	1918.	1913.	1919.	1918.	1913.
	cwt.	cwt.	cwt.	£	£	£
Butter	1,558,172	1,578,658	4,139,028	19,843,964	19,769,738	24,083,658
Margarine	459,369	301,650	1,518,297	2,229,838	1,563,405	3,917,701
Cheese	2,124,715	2,357,103	2,297,340	15,219,178	15,905,858	7,035,039
Milk, condensed—						
Unsweetened ..	1,033,385	900,696	50,008	4,087,168	3,495,768	89,984
Sweetened ..	2,150,535	1,666,994	1,202,207	11,835,076	9,035,173	2,095,437
	Great	Great	Great			
	hundreds	hundreds.	hundreds.			
Eggs	5,644,395	2,656,415	21,579,950	8,613,326	4,621,649	9,590,602

Butter.—The figures in the above table show a practically stationary import trade, both in quantity and value, for the years 1919 and 1918, though a big drop on the pre-war figures. It is noteworthy that the bulk of the produce came from distant parts of the world, 318,872 cwt. being declared from New Zealand, 267,675 cwt. from the Argentine, 216,495 cwt. from the United States and 214,689 cwt. from Victoria. Denmark, which before the War was by far our principal country of import, sending us in 1913 no less than 1,706,759 cwt. (or more than the total quantity imported in 1919) only exported 290,291 cwt., a considerable increase, however, on the 1918 figure of 40,327 cwt. Russia exported 6,954 cwt. as against none in 1918 and 1917, but 751,414 cwt. in 1913, when she was the second largest country of import in this commodity.

Cheese.—The quantities of cheese imported recorded in the table above show very little drop as a result of war conditions, although in regard to value there is an increase of 116 per cent. between 1913 and 1919.

There was considerable change in the countries whence we receive our supplies. The New Zealand trade increased from 547,182 cwt. to 1,230,553 cwt., while a decrease from 1,293,768 cwt. to 647,212 cwt. is to be noted in the case of Canada, and from 22,449 cwt. to 19,856 cwt. in the case of the United States. The Netherlands figures show a decrease from 291,895 cwt. to 79,217 cwt. It may be stated that before the War Canada was easily the leading country of import, supplying us with more than half of our total imports, New Zealand being second and the Netherlands third.

Eggs.—The number of eggs imported during 1919 was 5,644,395 great hundreds, as against 2,656,415 great hundreds in 1918 and 21,579,950 great hundreds in 1913. The values of these quantities were declared, respectively, at £8,613,326, £4,621,649, and £9,590,602. The figures show that the importation of eggs, which decreased very con-

siderably as a result of war conditions, has shown a marked increase during the past year, although it is still a great deal below the pre-war quantity, while the cost to the British purchaser has not decreased to any very appreciable extent. The marked fall in our imports of eggs is perhaps due chiefly to the fact that Russia during the past two years has dropped entirely out of the trade. This fact will be better appreciated when it is pointed out that in 1913 Russia sent us nearly 11,453,277 great hundreds, or more than twice the number imported from all countries during 1919. A noticeable feature as regards the countries whence the eggs were consigned is the increase in the importation from North America, Canada exporting 1,476,962 great hundreds (388,985 great hundreds in 1918) and the United States 1,408,606 great hundreds (337,345 great hundreds in 1918). Denmark, however, is our principal supplier, sending us 1,638,067 great hundreds in 1919 as against 1,170,535 great hundreds in the previous year, but 4,265,000 great hundreds in 1913.

GRAIN AND MEAL.

Imports of Grain, Pulse and Meals.

Description.	Quantities.			Value.		
	1919.	1918.	1913.	1919.	1918.	1913.
	cwt.	cwt.	cwt.	£	£	£
Wheat	71,432,400	57,947,610	105,878,102	68,431,182	53,097,953	43,849,173
Wheat meal and flour	17,692,170	26,359,600	11,978,153	25,700,817	35,682,697	6,347,771
Barley	16,043,900	5,025,200	22,439,248	17,836,137	5,426,012	8,077,100
Oats	6,716,221	10,982,570	18,162,663	6,723,151	11,529,053	5,671,057
Peas	1,136,351	2,180,665	1,978,375	2,583,069	5,406,069	1,006,735
Beans (other than haricots) ..	730,975	438,511	1,540,405	875,150	641,782	568,189
Maize	16,860,900	14,490,177	49,154,933	13,725,033	13,678,534	13,769,793
Oatmeal	1,375,019	2,908,429	868,877	2,319,703	4,823,821	607,761
Maize meal ..	2,313,768	1,447,664	491,827	2,252,446	1,631,090	182,413
Other corn and meal	10,321,553	14,623,099	10,791,419	14,309,947	22,251,683	5,413,736
Total	145,207,257	136,403,525	225,283,962	154,753,635	154,168,694	85,494,628

Our supplies of wheat during 1919 were received principally from the United States (31,768,300 cwt.), Canada (17,857,800 cwt.), Australia (14,950,500 cwt.) and the Argentine (6,818,800 cwt.). Barley was received from the United States (10,793,200 cwt.) and Canada (4,830,200 cwt.); and oats from the United States (2,956,021 cwt.), and the Argentine (2,069,700 cwt.).

Maize was chiefly imported from the Argentine (13,914,800 cwt.), and Beans from China (526,690) cwt.

FRUIT AND VEGETABLES.

Fruit.—Raw fruit was imported to the value of £29,685,782 in 1919, as compared with £13,515,978 in 1918 and £11,625,979 in 1913. It is not possible to give the quantities which these values represent, but the following figures as to the quantities of certain kinds of fruit imported which may compete with the produce of the British farmer are of interest:—

	1919. cwt.	1918. cwt.	1913. cwt.
Apples	2,967,284	410,169	3,257,419
Pears	372,799	2,436	718,928
Plums	88,291	—	409,877
Cherries	19,121	50	62,267
Strawberries ..	35,831	—	15,040
Currants	52,531	1,981	108,691
Gooseberries ..	16,906	—	8,086

Vegetables.—*Import of Vegetables.*

	1919.	1918.	1913.
Potatoes, cwt.	988,879	1,015,793	9,427,316
Onions, bush. ..	6,931,635	4,342,586	9,105,164
Tomatoes, cwt.	1,306,368	516,412	1,582,986

The bulk of our supplies of potatoes came from the Channel Islands (744,963 cwt.), with the Netherlands second, and France third. The potato harvest in England and Wales in 1919 amounted to 2,733,000 tons, which, although 1,476,000 tons less than in 1918 (by far the largest crop recorded) is 50,000 tons more than the pre-war average.

The importation of hops recovered from 52 cwt. in 1918 to 154,453 cwt. in 1919, as against the 1913 figure of 262,184 cwt. The values were:—1919, £2,374,115; 1918, £210; and 1913, £1,753,003. The United States has remained the principal country of import. The total production of home-grown hops in 1919 amounted to 194,000 cwt., which is half as much again as that of last year, but only about less than half of the pre-war average.

CLOVER STEM-ROT.

(*Sclerotinia trifoliorum*, Erik.)

A. D. COTTON,

Mycologist to the Ministry of Agriculture and Fisheries.

THE fact that Red Clover, if grown repeatedly on the same land, suffers from "Clover Sickness" has been common knowledge for more than a century. For many years the nature of this malady was a matter of speculation, but the work of various investigators has shown that it is due to at least two distinct diseases, the one caused by the eelworm *Tylenchus devastatrix*, and the other by the fungus *Sclerotinia trifoliorum*. In spite of this, however, it is only quite recently that the symptoms of the two diseases have been generally recognised and the appropriate methods of treatment adopted.

The most recent work* shows that amongst leguminous crops species susceptible to one disease are not necessarily

* See Amos, A., *Jour. Roy. Agric. Soc. England*. Vol. 79, pp. 68-88.

susceptible to the other, and, *vice versa*, hence the extreme importance of correctly identifying the nature of the disease. The present article deals solely with the fungus disease now usually termed Clover Stem-rot and caused by the fungus *Sclerotinia trifoliorum*. The Clover Eelworm Disease is dealt with in Leaflet No. 46, issued by the Ministry.

Description of Clover Stem-rot.—Stem-rot attacks the clover plant in winter and spring, and causes a rotting of the leaves and shoots. If the attack is slight, the crowns may escape damage and later develop healthy growth, but in bad cases the fungus works down into the roots and completely kills the plants. In damp weather the disease spreads rapidly and in a short time destroys the foliage of whole fields; if dry or frosty weather prevails its progress is checked, but it is liable to renew its activity with the recurrence of suitable weather-conditions in spring or, indeed, at any time up to the cutting of the crop.

Careful inspection shows that Stem-rot usually commences in November. Spores of the fungus *Sclerotinia* are at that season abundant in the air and give rise to the disease. Having once gained a footing, the fungus, which appears externally as a sparse white mould, spreads readily over the foliage. The affected leaves and shoots are quickly destroyed and turn a characteristic olive-brown or yellowish-brown colour. Many separate spore-infections usually occur in any given area, but in addition to this, owing to the close proximity of the clover plants, the fungus easily spreads from one plant to another.

All the stems are not necessarily killed, and the shoots which escape injury, together with new buds from the crown, develop fresh growth in spring, though this is naturally rather weak. In bad cases, however, the fungus invades the roots and kills the plants outright; and when damp, muggy conditions prevail, and the land is thoroughly infested, very serious loss over an extensive area may occur.

Contamination of the Land.—The fungus perpetuates itself in the soil by means of resting bodies known as sclerotia. These bodies, which are formed chiefly early in the year and in spring, are hard, black in colour, and spherical or flattened in shape. The sclerotia occur chiefly around the collar of the plants or on the dead roots, and may be found 3 or 4 in. below the surface of the soil (see Fig. 1). They also occur in and on the stems, in which position their development may readily be traced. It will be seen that each arises as a dense, white, cushion-like growth which soon turns grey and finally becomes firm with a hard, black coat. Inside they are white and of the

texture of cheese. It is important to be able to recognise these bodies since they form one of the readiest methods of identifying the exact nature of the disease.

The sclerotia, when buried in the soil, are capable of retaining their vitality for a number of years. In any case they remain dormant during the summer after their production, but may germinate with the rains and cooler weather of late autumn and give rise to bodies producing spores. In order to germinate they have to be near the surface. Those that are deeply buried remain dormant and germinate at irregular intervals, as they are successively brought to the surface in the ordinary routine of farm cultivation.

On germination the sclerotia give rise to small, brownish pink, cup-shaped toadstools (*apothecia*) (see Figs. 2 and 3), which contain in their upper portions vast numbers of spores. In common with many fungi belonging to the same group, the apothecia when mature forcibly discharge their spores, which on a warm, sunny day are visible as minute clouds.

These spores alight on the foliage of the surrounding plants, and readily germinate, thus giving rise to the mycelium which produces the new infection.

Relative Susceptibility of Leguminous Crops.—The fungus *S. trifoliorum* attacks many kinds of leguminous plants, though with varying degrees of intensity. The following list is based on observations carried out in Cambridgeshire* :—

Common or Broad Red Clover.—Extremely susceptible.

Late-flowering Red Clover or Single-cut Cow-grass—Very susceptible.

Lucerne.—Very susceptible during the first year, less so later.

Sainfoin.—Susceptible, especially the first year, occasionally severely attacked.

Trefoil.—Not often severely attacked.

Alsike or Swedish Clover.—Occasionally attacked, but not severely.

Dutch White Clover.—Occasionally attacked, but not severely.

It must be remembered that the above list refers exclusively to the Stem-rot Disease. The names of the varieties resistant to the Eelworm Disease will be found on p. 4 of Leaflet No. 46. Of other plants the disease is known to attack beans, but crops of peas and tares are apparently quite immune.

Distinction between Stem-rot and Eelworm Disease.—The leaves and shoots of plants attacked by *Stem-rot* die off rapidly in late autumn and winter and turn an olive-brown colour ;

* For further details see paper by A. Amos, referred to on p. 1241.

subsequently, the black sclerotia develop on the dead roots and stems. If the crown is not injured the plants may make new growth in spring and largely recover. Stem-rot is more or less regularly distributed over the fields, though certain portions may be more seriously affected than others.

In the case of *Eelworm Disease* the affected plants first turn pale in colour and the new growth is stunted, the stems being short and swollen and the leaves deformed. Diseased plants may live for some time, but they never recover, the foliage finally turning brown and the plants dying away. The Eelworm Disease commences from definite spots and spreads slowly but steadily outwards from these.

Control Measures.—In order to starve the fungus out of the land as completely as possible, an interval of at least 8 years, and preferably 12, should be allowed before sowing common red clover or late-flowering red clover (single-cut cow-grass) on infested land.

During this time the less susceptible crops, sainfoin, trefoil, alsike, or Dutch white clover should be substituted, either alone or with Italian rye-grass. Peas and tares may also safely be taken.

When red clover is next taken it should be sown in conjunction with Italian rye-grass or with alsike and trefoil.

It has been observed that red clover, if sown amongst wheat after beans, often becomes badly diseased. This sequence, therefore, should be avoided.

With regard to manures, further research is needed, but heavy dressings of organic and nitrogenous manures should be avoided, and an adequate supply of lime, potash and phosphates will tend to produce robust growth. On rich land subject to disease, grazing by sheep in September and October is of some value in reducing the thick foliage and so checking the rapid spread of the fungus.



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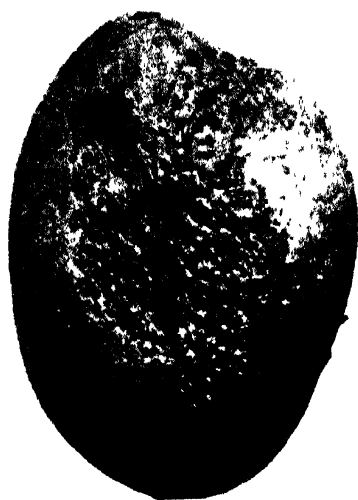
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FIG. 1.—Drawing of dead Red Clover root in spring showing the black sclerotia at the collar and on the root. "

FIG. 2.—Drawing showing the "toad-stool" like bodies (apothecia) produced from the sclerotia with the soil washed away. These fungi develop in late autumn and discharge spores which bring about new outbreaks of the disease.

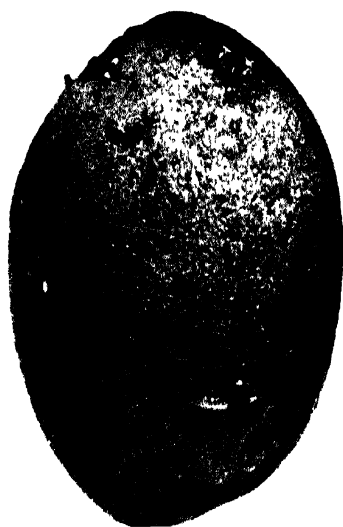
FIG. 3.—Photograph of a group of apothecia *in situ*. (For this photograph the Ministry is indebted to Mr. F. R. Petherbridge, M.A., of Cambridge University.)



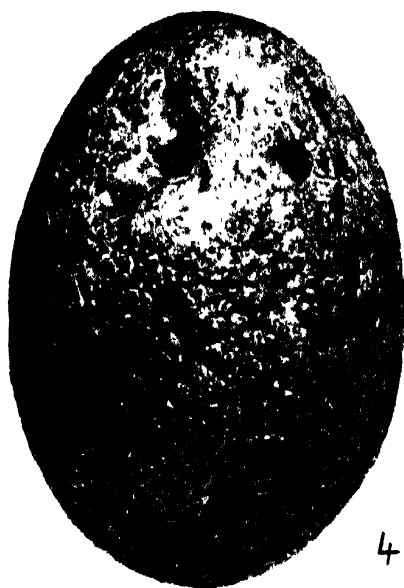
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Potato Tubers affected with Skin Spot. 1, 3, 4, Arran Chief ; 2, British Queen.

THE SKIN SPOT DISEASE OF POTATO TUBERS.

(*Oospora pustulans*.)

THE following is an abridged and slightly modified account of a paper by Miss M. N. Owen on the Skin Spot disease of potato tubers. The research was carried out in the Ministry's Laboratory for Plant Pathology at the Royal Botanic Gardens, Kew, and the original paper was published in the *Kew Bulletin of Miscellaneous Information*, No. 8, 1919. As this little-known disease appears to be on the increase, and as it is capable of causing considerable damage to the eyes of "seed" potatoes, it is thought advisable to reprint a portion of the article and one of the illustrations. For technical details the reader is referred to the full paper.

Introductory.—The disease known as Skin Spot is one of the minor diseases of potato tubers, and one which has never been thoroughly investigated. It is essentially a disease which develops in storage, a fact which probably accounts for its having been so long overlooked and so little understood. In certain seasons, however, Skin Spot is very abundant, and it appears to be becoming more prevalent than formerly. The affected tubers are dotted over with small dark spots, which are at times so numerous as to weaken or even to kill the eyes, and by disfigurement to lower the market value of the tubers.

In this article a description of the causal fungus, which proves to be a new species of the genus *Oospora*, is given, together with an account of its growth in pure culture, infection experiments, and notes as to the effects of the disease on the tubers. Although there is room for further work to be carried out with regard to the Skin Spot disease and the causes contributing to its development, it is thought that the results obtained should be placed on record, especially since no detailed account of the disease exists, and the identity of the fungus causing the disease was quite unknown.

External Appearance of the Disease.—The external characters of "Skin Spot," although not very striking, are quite distinctive, and there is not much likelihood of confusing it with other "spots." When a large number of potatoes are examined it becomes apparent that the spot may assume a some-

what different form according to the variety of potato on which it occurs. In the case of the coarser-skinned varieties, such as "Arran Chief," a definite pimple is developed, and the skin, which is never ruptured, is stretched tightly over the swelling, giving it a rather shiny appearance, which is most marked when a number of spots have arisen so close to one another that they coalesce. These swellings when dry are very similar in colour to the normal skin, but on being wetted stand out as a darker brown. In the case, however, of the thinner-skinned and smooth varieties, such as "King Edward," the diseased areas are rarely if ever raised, but consist of small sunken dark circular spots with a slightly raised centre, the area being brown or even black in colour. The latter agrees exactly with the description given by Pethybridge. These two forms have never been noted on one and the same tuber; intermediates, however, sometimes occur. In the case of both the pimple and the flat form, each affected area appears to be the result of individual and separate infection, and rarely extends for more than 1 mm. in diameter, or to a greater depth than 2 mm. It has been stated that the rose-end of the tuber is more liable to infection than the heel-end, but when a large number of specimens are examined this statement is not found to hold good. Very frequently, however, one side will be much more spotted than the other. Often the spots occur so close to one another that many of them merge, and thus extend over a considerable area, rendering the tuber very unsightly and injuring a considerable portion of the surface tissue.

A noteworthy point in connection with Skin Spot is the ease with which an entire spot or scab may be picked out. If removed with the point of a needle a white socket of sound potato tissue is usually left behind. The explanation of this is seen by means of a section, when it becomes apparent that the injured area is cuticularised and thus sharply isolated from the cellulose parenchyma of the flesh.

Microscopic Characters.—On sectioning one of these spots the hyphal threads of the invading fungus are plainly seen among the cells of the potato tissue which have become brown and dead. The filaments are exceedingly fine, 2–4 μ in diameter, hyaline or pale brown. The cell-walls appear to be somewhat thickened and cuticularised and to be lined with a brown substance, due probably to the decomposition of the cell-contents. The fungus penetrates below the periderm and invades the parenchyma, often to a depth of 12–15 cells.

The starch grains in the invaded cells entirely disappear. The progress of the fungus is apparently retarded by the cuticularisation of the cell walls, but attempts are also sometimes made on the part of the potato to form definite layers of cork below the affected part. In some cases successive layers of cork are formed. Early in April, when the fungus appears to be most vigorous, the hyphæ in the diseased cells are very numerous and for the most part hyaline; but later in the season, if similar areas are examined, very few hyphæ are found, and these are mostly brown, probably as the result of age. Judging from the smallness of the area which results from each infection, and from the fact that after a certain period of time the hyphæ, instead of penetrating to fresh cells, gradually die, the fungus can be regarded as only a very weak parasite on the potato tuber.

Pure Cultures of the Fungus.—In the article published in the *Kew Bulletin* there followed here an account of pure cultures of the fungus in the Laboratory and a discussion as to its systematic position. The fungus is named *Oospora pustulans*, Owen and Wakelield, and a technical description is supplied. An account is also given of the inoculation experiments carried out at Kew, where potato tubers were successfully inoculated with portions of the fungus grown in pure culture.

Possible Methods of Spread.—The following two sets of experiments were conducted in order to ascertain by what means the disease is carried from one season to another, and its method of spread in the soil.

The first set was carried out in pots. Clean tubers of "Midlothian Early," "Witch Hill," "British Queen," and "May Queen" were planted singly, at the end of April, in soil with which had been mixed peelings of diseased tubers. It was ascertained a few weeks later that the fungus was growing out from the inner side of the potato peelings, and was developing an abundant supply of spores. It is obvious, therefore, that the soil could easily be infected in this way.

The second series was conducted on the experimental ground at Kew, in a plot where the soil is a sticky silt. In order to test the possibility of the plants contaminating the soil a number of very badly infected tubers were planted in spring. The results showed that very little spread appears to take place during the first season, as on lifting in autumn, the crop was perfectly clean and no spots developed on the tubers during winter. It should be noted, however, that though the blotches or pimples produced by this fungus are sometimes ruptured under artificial

conditions, this does not take place naturally, so that in nature the fungus does not, perhaps, readily gain access to the soil, probably not until after the tubers decay. Should the soil be suitable for the fungus, in all probability tubers planted the following season would yield an infected crop.

Economic Importance of the Disease.—Since Skin Spot is a disease which develops in store and is not usually visible until the early spring, its economic importance might be expected to be slight. With regard to *ware* potatoes this is correct, for, as its name implies, the diseased areas are for the most part confined to the skin, and though the flesh of the tuber is penetrated to a slight extent by the fungus, it entails no appreciable waste in peeling. Beyond, therefore, rendering the tubers unsightly, and thus somewhat reducing their market value, this form of injury is not great.

In the case of *seed* potatoes, however, Skin Spot is of considerably more importance. When a crop in spring shows much infection, or the spots on the tubers are closely crowded together, there is a great danger of the eyes being injured. If the eyes are unaffected the shoots will grow and the plants will yield a normal healthy crop. This has been proved during two consecutive seasons at Kew. It should be remembered, however, that if the soil be suitable for the fungus it may become badly contaminated with the fungus, and future potato crops will be liable to suffer. On the other hand, where infection has taken place in the neighbourhood of the eyes, the eyes are definitely injured and even killed. Examination of tubers affected at the eyes shows that the fungus appears to penetrate, particularly deeply, the tissues around the eyes, and that in many cases relatively large areas of tissue may be killed. It has been observed by means of sections that the fungus at times not only kills the tissue around the eye, but also that immediately below it.

Although the primary eyes may be killed, it sometimes happens that secondary eyes may develop. Tubers of "King Edward," most of the eyes of which had been killed by *Oospora*, were placed in boxes to sprout in the usual way, and it was found that of the injured and killed eyes about 45 per cent. developed secondary eyes. Sections through some of these showed that the new buds had pushed their way through the dead tissue. This method of development has been described by Goebel* These new buds appeared to be fairly strong and

* Einleitung in die Experimentelle Morphologie der Pflanzen, 1908, pp. 221-222.

their production affords an explanation of a phenomenon noted when badly spotted tubers were planted at Kew, namely, that all the tubers developed strong plants. On account of the check at the start, however, the plants would be later, and the yield reduced. Though these secondary eyes are undoubtedly developed fairly frequently, many eyes are killed completely, and if it can be avoided it is highly undesirable to plant badly spotted tubers. It has been suggested that the development of Skin Spot is favoured by bad ventilation during storage, but from observations made in England last year it is clear that Skin Spot is often entirely absent in very badly ventilated clamps, and that it sometimes develops in pits where the ventilation is at all events quite up to the average.

The evidence at present available points to the fact that Scotch seed is more affected than English seed, but the question as to whether this is the result of more generally affected soil, the nature of the season, or the methods of storage, must remain over for a future investigation.

Summary.—The disease of potato tubers known as Skin Spot is caused by a fungus belonging to the Hyphomycetes. The fungus is not *Spicaria solani*, Harting, as has been previously thought, but a minute species hitherto undescribed, which appears most suitably placed in the genus *Oospora*, and is described as a new species *O. pustulans*. The fungus grows readily as a saprophyte in culture, including agar and gelatine media, but more freely on sterilised vegetable tissues. The morphological characters of the fungus as seen in artificial cultures are described in detail.

Field inoculations with spores of the fungus were successful in a certain number of cases in producing the spot on the tubers, and the fungus was re-isolated from the affected tubers. Further work on the life history of the fungus is required, as it is not certain whether the tubers are infected in the soil only or also during storage. The exact type of soil and the conditions under which Skin Spot develops with special virulence are not yet clear.

With regard to the injury caused by the disease, the fungus is confined to the surface layers, and is often sharply isolated from the mass of the flesh by a layer of cork cells. Tubers, however, may be so severely spotted as to be greatly disfigured and to be depreciated in value. In addition to this it is shown that previous suppositions with regard to the injury caused by the fungus to the eyes were correct. When infection takes place in the neighbourhood of the eyes these are weakened or

killed. In spite of the fact that in some cases secondary eyes are developed, seed tubers may undoubtedly be very seriously injured when the fungus is present in quantity. The only preventive measure which can be recommended at present is to avoid planting diseased tubers. If badly affected tubers are planted, not only are "misses" likely to occur, but the soil is likely to become seriously contaminated with Skin Spot fungus.

AGRICULTURE ABROAD.

On the basis of semi-official returns Professor Honcamp, of Rostock,* gives the following figures as to the consumption of artificial manures in Germany during twelve months just prior to the outbreak of war and twelve months ended shortly before the cessation of hostilities :

Manures in Germany and Sweden.

	Nitrogen. (N). Tons.	Phosphoric Acid. (P ₂ O ₅). Tons.	Potash. (K ₂ O). Tons.
1st May, 1913 to 30th April, 1914	210,000	630,000	557,350
1st May, 1917 to 30th April, 1918	92,334	325,800	779,400

Calculated in pounds per acre (roughly 32,000,000 hectares, 80,000,000 acres, under cultivation in Germany 1913-14) these figures would work out :

	Nitrogen. (N).	Phosphoric Acid. (P ₂ O ₅).	Potash. (K ₂ O).
1913-14	5.84	17.5	15.5
1917-18	2.56	9.06	21.68

This would amount to an application in pounds per acre of total cultivated area of the following quantities of sulphate of ammonia (20 per cent. N.), superphosphate (18 per cent.) and kainit (13 per cent.) (or their equivalents—nitrate of soda, nitrolim etc. ; basic slag ; potash salts).

	Sulphate of Ammonia. lb.	Super- phosphate. lb.	Kainit. lb.
1913-14	29.2	97.2	119
1917-18	12.8	50.3	167

* Ueber Produktion Verbrauch und Bedarf an Pflanzennährstoffen.
Fühling's Landw. Zeitung, 15/16 Heft, 1919, p. 282.

To the artificial manures must be added (1) farmyard manure, estimated before the War at 200,000,000 tons, with a content of 0.3 per cent. each of nitrogen and potash and 0.15 per cent. of phosphoric acid and (2) green manuring, which, it is estimated, was ploughed in on about 800,000 acres.

The various amounts of plant food from the different manures give the following totals :—

Year 1913-14.				Nitrogen.	P ₂ O ₅	K ₂ O.
				Tons.	Tons.	Tons.
Farmyard manure	..	..	..	600,000	300,000	600,000
Green manuring	..	..	..	28,772	7,870	22,798
Artificials	..	..	..	210,000	630,000	557,350
				<u>838,772</u>	<u>937,870</u>	<u>1,180,148</u>

The writer points out that the chief anxiety of Germany for the future will centre round phosphates, the production of superphosphate depending entirely, and the production of basic slag to a considerable extent, on imports. In 1910 Germany's output of basic slag was 62.3 per cent. of the world's total. This, however, was only possible with a large import of, chiefly, phosphatic ores, the imports amounting to 11,000,000 tons of ore as against a home production of 23,000,000 tons.

An article in the *Frankfurter Zeitung** estimates the total nitrogen consumption of Germany in 1913 at 222,500 tons, of which amount Chilian nitrate contributed more than one half. Now that the Aniline Syndicate has decided to double its capital by an issue of shares to the value of 300,000,000 marks, it is calculated that the output of nitrogen by the Haber-Bosch process will reach 300,000 tons annually, which is more than the total consumption before the War. The addition of sulphate of ammonia and nitrate of lime opens up the prospect of an output of 400,000 to 500,000 tons.

The report of the Swedish War Food Committee estimates the total amount of animal manure produced in Sweden in the year 1912-13 at 22,612,105 tons. The manurial values assigned are, however, about half as much again as those given in the German estimate above. No allowance is made for green manuring, but, on the other hand, human manure is included.

* *Chimie et Industrie*, Vol. 3, No. 1, January, 1920, p. 138.

The following table sums up the total tonnage of plant food produced for the year in question :—

Production and Consumption of the various Plant-foods,
1912-13.

Kind of Manure.	Nitrogen.			Phosphoric Acid.			Potash.		
	Production.	Importation.	Consumption.	Production.	Importation.	Consumption.	Production.	Importation.	Consumption.
	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
Animal manure	100,836	—	100,836	57,156	—	57,156	117,745	—	117,745
Poudrette ..	333	—	333	166	—	166	133	—	133
Latrine ..	3,900	—	3,900	3,000	—	3,000	1,200	—	1,200
Artificial Manure ..	2,017	4,081	6,098	3,515	28,891	32,406	—	19,668	19,668
Total ..	107,086	4,081	111,167	57,837	28,891	86,728	119,078	19,668	138,746

[NOTE.—The totals for animal manure, calculated on the same basis as Honcamp's figures above, work out respectively at Nitrogen and Potash, 67,836 tons, and phosphoric acid, 33,918 tons. This will reduce the three total consumption figures to nitrogen, 78,167 tons, phosphoric acid, 69,490 tons, and potash, 88,837 tons.]

(*Sv. Allmänna Landbruksskaps Medlemsblad*, No. 9, 1919.)

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By a law of 31st October, 1919,* local authorities of the French departments and communes are empowered to acquire land for the purpose of re-selling in lots for labourers' cottages and small holdings.

Peasant Proprietorship in France.

The lots for labourers' cottages, including a garden, are not to exceed 10 ares ($\frac{1}{4}$ acre); small holdings of whatever area are not to exceed 10,000 francs (£400)† in value. The preamble defines the object of the law as being to facilitate the acquisition of small properties by labourers and by poor families, and it is provided that in disposing of the lots regard is to be had to the character of the applicants and the number of children. Further, preference is to be given to those who, for the purpose of purchase, have obtained long term credit from a recognised source. The land is to be offered at such a price that the local authorities neither gain nor lose on the transaction; the price is to be cash down. The conditions imposed upon the purchaser are that properties so acquired may not be disposed of for ten years, may not be used for other purposes, and, in the case of a small holding, that the land be cultivated by the holder himself or with the aid of members of his family.

* *Journal Officiel*, 1st November, 1919.

† Normal exchange.

In an article on a strike of farm-hands in the Province of Groningen, Holland, which lasted from the 5th May to the 21st July of last year, M. F. P. Lohnis* **Agricultural Labour in Holland.** gives some interesting facts as to hours and conditions of labour in that part of Holland. In the north and south-east of the Province it is customary to work from 6 to 11.30 a.m. and from 1 to 5.30 p.m. In the intervening district (the Oldambt) work begins at 5 or 6 a.m., and is carried on until 1 or 2 p.m. Afterwards the labourer's time is at his own disposal. Many of the labourers are provided with a not inconsiderable piece of farm or garden land, for the working of which they are by local custom allowed the use of their employers' horses, and have certain other perquisites. They are thus able to keep a small amount of stock of their own, and are to some extent rather small holders than mere labourers.

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A RECENT Belgian law on agricultural education, published in the *Moniteur Belge* of 1st December, takes the place of the law of 4th April, 1890. The new law **Agricultural Education in Belgium.** provides for two higher agricultural institutes, at one of which instruction shall be given in French, and at the other in Flemish. The Government system of agricultural training may also include the establishment of agricultural schools, both primary and secondary, and courses of teaching and lectures on agricultural and horticultural subjects. The Government may further, under certain conditions, subsidise agricultural and horticultural schools, courses and lectures, organised by communes, public bodies, or individuals. Hitherto the Belgian Government has only possessed one higher agricultural institute—that of Gembloux; apart from this all methods of instruction provided for in the new law would appear to have been in existence under the old. One of the most interesting features of the Belgian system are the lectures and courses of training on agricultural subjects, for which the Government agricultural experts (*Agronomes d'Etat*) are responsible. In the winter of 1910-11, courses of a varying number of lessons were given in 367 centres, and the average attendance at each lesson was 65. The lectures for farmers' wives in the same winter numbered 392, with an average attendance of 67. Another feature is the travelling school for

* *Tijdschrift der Nederlands. Heidemij.*, 1st February, 1920.

girls (*Ecole ménagère ambulante*) which gives training in the domestic side of farm life, including dairying. The school generally remains for about four months in one locality and then moves on to another. In the three years ended 1911 there were 79 sessions, attended by 1,372 pupils, of whom 1,221 obtained the final certificate.*

The Agricultural School of the University of Louvain was, before the War, a very important factor in Belgian agricultural education. It was not supported by Government funds.

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A TABLE has been prepared, showing the number of live stock per 100 acres of cultivated land in the United Kingdom and other European countries. The total cattle per 100 acres in the United Kingdom is 25, as against 40 in Belgium, 38 in Holland, and 32 in Denmark. There are 9 dairy cows to the United Kingdom's 100 acres, as against 20 on a similar area in Belgium, 20 in Holland, 18 in Denmark, and 15 in Sweden. There are 8 pigs, as against 30 in Belgium, 23 in Holland, 21 in Denmark, and 26 in Germany. The number of goats in the United Kingdom is so small that it is not expressed in figures. Switzerland is said to keep 6 to the 100 acre, Germany 4, and Holland 4.

NOTICES OF BOOKS.

The Soil : an Introduction to the Scientific Study of the Growth of Crops.—Sir A. D. Hall, K.C.B., F.R.S. (London : John Murray, 1920, 7s. 6d. net). The third edition of this well-known standard work, recently published, is arranged on similar lines to the second edition, but the author states that after an interval of eleven years considerable revision has become necessary in a book dealing with a subject growing so rapidly as the science of the soil. During the period in question the chief addition to knowledge has been the extended light upon the organisms of the soil, and their functions gained through the Rothamsted investigations. The current views upon the structure of clay and many of the reactions of the soil in which the clay takes part have been considerably modified through the development of the conception of colloids which has taken place of late years. In many other instances it has been found necessary either to record some additional knowledge or to modify the point of view. The volume ends with a useful bibliography.

Food Supplies in Peace and War.—Sir R. Henry Rew, K.C.B., (London : Longmans, Green and Co., 1920, 6s. 6d. net). In this book

* *Situation de l'Enseignement Agricole. Rapport Triennal, Années 1909—1911, Bruxelles, 1913.*

Sir Henry Rew is mainly concerned with the condition of agriculture in Great Britain before, during, and after the War, from the point of view of the farmer and the outlook of the consumer. He compares very favourably the returns obtained from British agriculture with those recorded in respect of the principal countries on the Continent, and suggests that there are indications of a rapid recovery of agriculture in Europe, following on the disturbing effect of the War, and that in this recovery Great Britain will play no inconsiderable part. A chapter of some length on the State control of food supplies during the War, and a short concluding chapter on the personal factor in the agricultural industry, are likely to be of particular interest to some readers in view of the special qualifications of the author to speak on these subjects.

The Fungal Diseases of the Common Larch.—W. E. Hiley (Oxford : Clarendon Press, 1919, 12s. 6d.). The great value of the larch tree is known to all foresters, but its successful culture is always risky owing to its extreme susceptibility to disease, especially Larch Canker. Many investigations have been carried out in the past and much has been written, the bulk of which was useful and sound. The appearance of a new book on the subject is of special interest, the more so since it is the product of a well-known worker in the School of Forestry at Oxford, and embodies the results of a special and critical study.

The book covers the whole field of larch diseases, the dreaded canker, the heart-rot diseases which are the cause of unsuspected damage in apparently healthy trees, the Honey fungus and the leaf and seedling diseases. Much space is devoted to causes predisposing the plants to disease, and to cultural details. The chapters on canker deal with the canker fungus, its growth in the tissues, its mode of entry, the importance of wounds, and many other questions connected with the subject. Perhaps the most important paragraphs are those in which the author puts forward at length his views on the manner in which the trees are naturally infected by the fungus, namely, through the small dead lateral shoots. He is of opinion that the entry by means of wounds, though frequent, has in the past been over-estimated. The whole section on larch canker is of great importance and should be widely read.

Only second in interest are the chapters on heart-rots. These are dealt with in detail and provide by far the fullest account available in the English language. The most dangerous fungus of this group is *Fomes annosus*, which is well known to give special trouble on land planted with trees for the first time. A view previously put forward, and here elaborated by the author, namely, that poor aeration of the subsoil causes the death of the main anchor roots, thus laying them open to attack by *Fomes*, is discussed, and appropriate preventive measures are suggested. The general conclusion, however, is reached that trees other than larch are more suitable for first rotation on agricultural land. Chapters on the exceedingly destructive Honey fungus and on the seedling and leaf diseases are also given, and the work concludes with a general summary in which many cultural details are discussed.

The work, which is freely illustrated, is a valuable and important contribution to the literature of the subject. Its appearance is particularly opportune and should be carefully studied by all interested in the cultivation of the larch.

Syllabus of the Morae Plunkett Foundation Lectures on Rural Sociology.—A. W. Ashby (Institute for Research in Agricultural Economics, Parks Road, Oxford, 6d., post free). These lectures were delivered by Mr. A. W. Ashby at the Barnett House, Oxford, during the Michaelmas term, 1919. The course was intended to provide an introduction to the study of rural society and to general social conditions in agricultural districts. Although not primarily historical, the lectures deal with aspects of the history of rural life in England and Wales during the 19th century. The reading courses suggested in the pamphlet should be of value to outside students.

Report of the Army Cattle Committee.—Part II.—(London: H.M. Stationery Office, 1919. 2d. net.) The Committee appointed in 1917 to make arrangements for the purchase of cattle in the United Kingdom for the feeding of the Army during the latter months of the year 1917 have recently issued Part II. of their Report. The period during which the Committee were called upon to provide the troops in Great Britain with home-killed meat extended from 1st September, 1917, to December, 1917, and during this time 76,186 head of cattle were purchased and dispatched to the abattoirs. The object of the issue of Part II. of the Report is to give particulars of the purchases, including the number and weight of cattle dealt with and the expenditure incurred during the period of the work. In their concluding observations the Committee record that their methods of organisation of purchase throughout the country formed the basis of the rationing and control of live stock by the Ministry of Food, which was extended to all civilian supplies at the close of the Committee's operations.

Part I. of the Report, which was issued in 1918 (price 1s. net.), contains the statistical data which the Committee used as the basis of their action in the purchase of supplies. A number of tables of returns of cattle and meat production in this country, are given, and should be useful for purposes of reference to those interested in the subject.

Report of the Inter-Departmental Committee on Meat Supplies.—(London: H.M. Stationery Office, 1919. 3d. net.) The terms of reference of this Committee were "to consider and report on the means of securing sufficient meat supplies for the United Kingdom at reasonable prices, with special regard to the development of meat production in the United Kingdom, and to the protection of British markets and of producing countries within the Empire from domination by foreign organisations." This wide subject is dealt with under four headings: (1) the present situation, (2) the future production with regard to the United Kingdom, Oversea Dominions, and British meat companies in foreign countries, (3) distribution in the United Kingdom, and (4) general anti-trust measures. The Report concludes with a number of conclusions and recommendations.

Report of the Oversea Settlement Committee.—(London: H.M. Stationery Office, 1920. 3d. net.) This Report is for the year ended 31st December last, and deals with the question of settlement overseas within the Empire, and emigration to foreign countries. The Committee make a number of observations and recommendations with a view of enabling the Government to deal with the problems which are likely to arise during the present period of "reconstruction." Certain information contained in the Report may be of interest to intending land settlers from this country, although little matter is purely agricultural.

Allotments.—In reply to questions by Sir K. Wood, the Parliamentary Secretary to the Ministry of Agriculture stated that the Minister had power under Section 3 (1) of the Land Settlement (Facilities) Act, 1919, up to 19th August, 1922, when he was satisfied that in any county

Replies to Questions in Parliament affecting Agriculture. the council were not providing land to be leased to a parish council or a parish meeting for the provision of allotments to such extent as in the opinion of the Ministry was desirable, to acquire land for the purpose. In the case of a borough council, other than a council of a county borough, an urban district council, or a parish council or meeting, if the Minister was satisfied after holding a local inquiry, that these councils and the County Council had failed to fulfil their statutory obligations to provide land for allotments, he might under Section 24 of the Smallholdings and Allotments Act, 1908, as amended by the Land Settlement (Facilities) Act, 1919 transfer the powers of the County Council to the Smallholdings Commissioners of the Ministry in order that the allotments required might be provided. Further, he was advised that there was no power under the Smallholdings and Allotments Act, 1908, or the Land Settlement (Facilities) Act, 1919, for the Minister or a County Council, to act in default of the council of a county borough in regard to the provision of allotments. He went on to state that the details of the constitution of the Council of Agriculture for England, the Council of Agriculture for Wales, and the Agricultural Advisory Committee of England and Wales had not yet been finally settled. In the model scheme for the constitution of a County Agricultural Committee, recently issued to all County Councils, they were recommended to include on the committee representatives of allotment societies. If, in the case of any county, the interests of allotment holders did not appear to be sufficiently represented among the members appointed by the County Council, the Minister would endeavour to secure that adequate representation was given to such interests among the members of the committee, which he himself was empowered to give. (19th February, 1920.)

Agricultural Supplies to make the United Kingdom Self-Supporting.

—In reply to a question by Mr. Lambert, the Parliamentary Secretary to the Ministry of Agriculture stated that the acreage in the United Kingdom under wheat, barley, and oats, respectively, in 1919, was :—

					Acres.
Wheat	..	..	..	..	2,370,000
Barley	..	..	..	..	1,870,000
Oats ..	..	..	..	..	5,117,000

[To render the United Kingdom self-supporting in cereals (excluding maize and other cereals not usually grown in this country) it was estimated that the area under the above cereals would have to be increased by about 10,700,000 acres, assuming average crops and a consumption (including seed and tail corn) at the level reached in 1919.

The number of cattle, sheep, and pigs in the United Kingdom in 1919 was :—

Cattle	..	..	..	..	12,454,000
Sheep	..	..	..	..	25,048,000
Pigs ..	..	..	..	..	2,914,000

On the basis of the consumption in 1919 it was estimated that these numbers would have to be increased to the following extent in order to make the United Kingdom self-supporting in beef, veal, mutton, lamb, bacon and hams :—

Cattle	..	..	..	..	6,400,000
Sheep	..	..	..	..	18,900,000
Pigs	..	..	..	..	6,700,000

The estimated increase in the number of cattle includes an increase in cows and heifers sufficient to produce the milk required to make the country self-supporting as regards butter and cheese on the basis of the consumption in 1919. (4th March, 1920.)

Potatoes.—In reply to a question by Major Wheeler whether potato growers might plant King Edwards, Arran Chief, and Up-to-date in clean and non-infected land in the coming season, the Parliamentary Secretary to the Ministry of Agriculture stated that he had ascertained in consultation with the Ministry of Food that there probably would be a shortage of home-grown potatoes prior to the 1920 crop becoming available, but that it is hoped to reduce the shortage as much as possible by importations from abroad. It was not possible at the present time to give any estimate of the 1920 crop, which would depend on the acreage planted and the weather conditions prevailing during the growing period. No alteration of the Wart Disease Order was contemplated which would affect in any way the varieties of potatoes planted during the coming season, but the Technical Advisers of the Ministry were giving careful consideration to the question of an alternative policy which might give certain concessions to the grower without endangering the further spread of the disease. (24th February, 1920.)

Consumption of Agricultural Produce.—In reply to a question by Mr. Lambert, the Parliamentary Secretary to the Ministry of Food stated that the estimated consumption by the United Kingdom during the year 1919 of wheat, barley, oats, beef, mutton, bacon, butter, and cheese was as stated in the following table :—

Commodity.	Estimated total Consumption.	Percentage of Home-grown and Imported Produce to Total.	
		Home-grown.	Imported.
	tons.	per cent.	per cent.
Wheat	7,395,000	27	73
Barley	1,956,000	64	36
Oats	4,297,000	92	8
Beef and Veal	995,000	66	34
Mutton and Lamb ..	368,000	57	43
Bacon and Hams ..	447,000	19	81
Butter	180,000	58	42
Cheese	145,000	30	70

NOTES.—Cereals.—The quantities are given after deduction for seed, and in the case of wheat, for tailings also.

Bacon.—The quantities given are for bacon as smoked or dried.

(16th February, 1920.)

Sulphate of Ammonia.—Replying to a question of Mr. Acland, the Parliamentary Secretary to the Ministry of Agriculture stated that under the existing arrangements the export of sulphate of ammonia was prohibited except under licence, and the price at which this material was sold by manufacturers and the Ministry of Agriculture and Fisheries. In regard to the future, the question was receiving the very close consideration of the Ministry with a view to securing adequate supplies of sulphate of ammonia and other fertilisers at reasonable prices after the close of the present season. (19th February 1920.)

Foot-and-Mouth Disease.—In reply to a question by Sir R. Cooper, the Parliamentary Secretary to the Ministry of Agriculture stated that there had been 28 initial outbreaks of invasion of Foot-and-Mouth Disease in England and Wales, from which 87 additional premises, contiguous or in the immediate vicinity, had become infected, making a total of 115 premises actually infected with the disease. With the exception of one case in Wales, all the outbreaks had occurred in England and Wales.

Each centre of initial invasion had been successfully eradicated and general dissemination of infection prevented. The Ministry's officers conducted a searching cross-examination of the owner and attendants of the affected animals with regard to each initial outbreak, but so far no connection had been traced. The spread of the disease to premises in the immediate vicinity of an initial outbreak had been traced to contaminated attendants, feeding stuffs, water, and to infected animals which changed hands before the Ministry's officers took charge. (3rd March, 1920.)

Waste Land Reclamation.—In reply to a question by Mr. Doyle, the Parliamentary Secretary to the Ministry of Agriculture stated that works were now being carried out for the reclamation of land in the neighbourhood of Wainfleet, on the northern shore of the Wash. Several schemes for the reclamation of land were prepared subsequent to the Armistice, with a view to finding employment for demobilised men. In view, however, of the urgent need for the curtailment of all public expenditure, it was recently decided that none of these schemes, other than that already referred to, should be proceeded with. (1st March, 1920.)

Live Stock.—In reply to a question by Brigadier-General Colvin, the Parliamentary Secretary to the Ministry of Agriculture stated that the Ministry were in constant communication with the Ministry of Food as to the slaughter of young stock, but in view of the comparative failure of the various Orders that had been made with the object of restricting slaughter it was considered undesirable to make any further Order of the kind at present. It was hoped that the situation would right itself when meat was decontrolled, but if not the matter would be further considered. (1st March, 1920.)

Tomato-growing.—In reply to a question by Mr. Gwynne, the Parliamentary Secretary to the Ministry of Agriculture stated that he could not agree that the tomato-growing industry was in any way overlooked by his Department. A grant was made to the Lea Valley Research Station, where many matters concerning the production of tomatoes were dealt with. The technical officers of the Department were fully qualified to deal with questions of culture, packing, grading

and marketing, and their advice on these matters was often sought. The question of obtaining statistics concerning the home production of tomatoes was engaging the attention of the Ministry, but the difficulties of obtaining data were very great. He understood that weekly returns of the imports of tomatoes could be obtained on application to the Commissioners of Customs and Excise. (3rd March, 1920.)

Potash imports from Germany.—In reply to questions by Sir R. Cooper, the President of the Board of Trade stated that no import licences were required for the importation into this country of potash from Germany. Certain quantities of potash salts had been received from Germany by His Majesty's Government as part payment for food supplied to Germany. They were taken over from the British Government by the British Potash Company for resale under the authority of the Potash Distribution Committee, which was set up to regulate the prices and conditions of sale. Maximum prices to consumers had been fixed, and the profits of the British Potash Company were limited to 1 per cent. of the gross turnover of the contract plus one-third of any further profit, the remaining two-thirds reverting to the Government.

He further stated that he did not know anything about the commercial importation of potash. No import licences were required, but in so far as we receive such potash in payment from Germany the British Government is bringing it in. (16th February 1920.)

THE monthly crop report of the Ministry on 1st March was as follows:—The mild and generally dry weather of February was very favourable for field work, but in some districts **Agricultural Conditions in England and Wales on 1st March.** in the north and west ploughing was checked by rains. On the whole, however, very good progress was made with cultivation, and this work is much more forward than is usual at the beginning of March. Spring sowing has been begun early and large areas have already been sown in the south and east. Autumn-sown crops have improved and, except for beans in some districts, are forward. Wheat is healthy and vigorous and a full plant, and winter oats and beans are very promising. It is estimated that there has been a considerable falling off in the area sown with wheat up to 1st March as compared with the area sown at the corresponding date last year. Probably from one-fourth to one-third of the wheat will need a top-dressing in the spring.

Seeds are very variable; where there is a good plant the crop has done well, but thin crops are common in practically all districts, and many fields have been ploughed up.

Ewes are in very fair condition. In the south-west, where lambing is now general, the fall of lambs is satisfactory, and losses have been few. In other parts of the country lambing in general is only just beginning, but so far the fall of lambs has been about the average and prospects are favourable.

The mild weather has been beneficial to live stock, and they have improved during February in some districts, though they are frequently in poor condition. Keep is still scarce but is lasting out better than was anticipated.

There is practically no change in the labour situation. In nearly all districts there are sufficient men available, but many are unskilled, and more trained horsemen and cattlemen are required.

Prices of Ground Basic Slag.—In consideration of the increase in the cost of production, and of the higher railway rates which have now to be paid on the raw materials, fuel, bags,

Official Notices. etc., the Ministry has authorised basic slag makers to withdraw the rebates of 2s., 3s., and 4s. per ton previously allowed for deliveries made during March, April, and May, respectively.

The agreed maximum prices for ground basic slag delivered in March, April and May, 1920, will, therefore, be the same as those ruling from 1st September, 1919, to 29th February, 1920. In all other respects the prices and conditions of sale announced in the notice F.P. 493/S.1* remain in force until 31st May, 1920.

Advisory Committee on Steam Cultivation and Threshing.—The Rt. Hon. the Lord Lee of Fareham, G.B.E., K.C.B., Minister of Agriculture and Fisheries, has appointed a Standing Committee to advise the Ministry on all questions affecting the steam cultivation and steam threshing industries in England and Wales. The Committee will be constituted as follows: Mr. H. L. French, O.B.E., one of the Assistant Secretaries of the Ministry (*Chairman*); Mr. John Allen, O.B.E. (*Vice-Chairman*); Mr. A. M. Cole; Mr. F. M. Elgar; Mr. Pearce Ellis; Mr. James Falconer, M.B.E.; Mr. Percy Grundy; Mr. J. N. C. Bay, and Mr. George Thurlow.

The Secretary of the Committee is Mr. C. S. Good (Ministry of Agriculture and Fisheries, 72, Victoria Street, S.W. 1), to whom all communications should be addressed.

Foot-and-Mouth Disease.—Since the issue of last month's *Journal*, outbreaks of Foot-and-Mouth Disease have been confirmed in two fresh centres, namely:—

Gloucestershire and Worcestershire.—The first outbreak in this District was confirmed on the 12th February at Leckhampton, near Cheltenham. The usual Order prohibiting the movement of animals over a wide area was issued on the same day. These restrictions have been considerably modified. Unfortunately, on the 27th February, an outbreak occurred on premises at Ripple, near Tewkesbury, about 15 miles to the north of Leckhampton, which necessitated the re-imposition of the entire prohibition of movement over an area covering a radius of about seven miles around these premises. No further outbreaks in this District have occurred since that date.

* See this *Journal*, June, 1919, p. 337.

Oxfordshire and Buckinghamshire.—On the 15th February Foot-and-Mouth Disease was confirmed on four separate premises in this District, namely:—two near Thame (Oxon), one at Bicester (Oxon), and one at Luggershall (Bucks). Further outbreaks were confirmed on the 18th February, near Bicester (Oxon), on the 21st February at Luggershall, on the 22nd February at Wendover (Bucks), on the 23rd February at Merton (Oxon), on the 26th February at Summerton (Oxon), and on the 27th February near Wendover (Bucks), making ten outbreaks in all in this District to date. It has been ascertained that all these outbreaks are connected with one another, but no origin has been discovered for the initial case. The usual Order prohibiting the movement of animals was issued on Sunday, the 15th February. These restrictions have since been modified as regards the Outer parts of the Scheduled District.

All restrictions on the movement of animals imposed in connection with the outbreaks in Bedfordshire, Northumberland, Flintshire, Lancashire, and Wiltshire have been withdrawn, and the restrictions in Devonshire have been reduced to a very small area around Bow.

Rabies.—The only events worthy of mention during the past month are as follows:—A case of Rabies was confirmed (on the 18th February) in a dog which was in quarantine on veterinary premises at Herisham, Surrey. This dog had been placed in quarantine on account of its having been bitten by the rabid dog condemned in the case confirmed at Addlestone on the 13th January.

The extent of the area subject to the Orders of the Minister relating to the muzzling and control of dogs in South Wales was considerably reduced as from the 10th March, and the more stringent restrictions applicable to the Inner Controlled Area apply only to two small Areas in the neighbourhood of Cardiff and Bridgend.

January Journal: Errata.—On p. 997, lines 8 and 9, in the passage in the article on Warble Fly describing the most effectual method of exterminating the insects, for "beginning early in May and continuing during June, July, and August," read "beginning in February or March, and continuing during April, May and June."

Fig. 2 illustrates the fully-grown state of the maggot, and the reference on p. 996, line 28, should, therefore, be transferred to line 33.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Martin, J. N.—Botany for Agricultural Students. (First Edition). (585 pp.) New York: J. Wiley & Sons; London: Chapman & Hall, 1919. 12s. 6d. net. [58(02).]

England and Wales, Memoirs of the Geological Survey.—Explanation of Sheet 154: The Geology of the Country around Lichfield. (302 pp.) London, 1919. 9s. net. [55: 912.]

Harper Adams Agricultural College.—Present Day Difficulties in Agricultural Production. (4 pp.) [Paper read before the Shropshire Chamber of Agriculture, November 29th, 1919.] [63.604(s).]

University of Leeds.—No. 109:—Ploughing out of Grass Land. (27 pp.) Leeds, 1919. [63.191.]

Sowerby, J. E., and Johnson, C. P.—British Wild Flowers. (168 pp. + 1600 figures in colours.) London: J. E. Sowerby, Mead Place, Lambeth, 1860. [58.19.]

Field Crops—

University of Leeds.—No. 112 :—Report on Tests of Varieties of Wheat, 1916-1919. (16 pp.) Leeds, 1919. [63.311(04).]

Hoagland, D. R.—Relation of Nutrient Solution to Composition and Reaction of Cell Sap of Barley. (8 pp.) (Reprinted for private circulation from the "Botanical Gazette," Vol. lxxviii., No. 4. October, 1919.) [63.113.]

Horticulture—

Spain, Ministerio de Fomento, Minas y Montes.—La poda de los agrios (The Pruning of Orchards). (16 pp.) Madrid, 1919. [63.41-195.]

Plant Diseases—

India Board of Agriculture.—Proceedings of the Second Meeting of Mycological Workers in India, 1919. (68 pp.) Calcutta, 1919. 1s. net. [63.292(54).]

Live Stock—

Barton, F. T.—The Cottager's Pig. (63 pp.) London: Jarrolds, 1919. 2s. 6d. [63.64(02).]

Powell, E. J.—History of the Smithfield Club from 1798 to 1900. (168 pp.) London: Smithfield Club, 1902. [63.70(06).]

Pearl, Raymond.—The Seasonal Distribution of Swine Breeding. [Reprinted from "The Scientific Monthly," September, 1918. (pp. 244 to 251.)] [63.64(04).]

Dairying and Food, General—

Starling, E. H.—The Feeding of Nations: A Study in Applied Physiology. (146 pp.) London: Longmans, Green & Co., 1919. 5s. net. [31: 612.39.]

Canada Department of Agriculture.—Report of the Proceedings of Dominion Dairy Conference held at Ottawa, 25th-28th November, 1918. (115 pp.) Ottawa, 1919. [63.70(06).]

Veterinary Science

University of Leeds.—No. 111 :—Contagious Abortion in Cows. (4 pp.) Leeds, 1919. [619.2(a).]

Birds, Poultry and Bees—

University of Leeds.—No. 110 :—Poultry Keeping. (15 pp.) Leeds, 1919. [63.651(04).]

Brown, E. T.—Ducks, Geese and Turkeys. (123 pp.) [Smallholder Library, No. 13.] London: C. A. Pearson, 1918. 1s. 6d. net. [63.657; 63.652; 63.658.]

Forestry—

Somerville, W.—Some Problems of Re-afforestation. (13 pp.) London: John Murray, 1919. 6d. net. [63.49(04).]

Engineering

Clayton, C. H. J.—Land Drainage from Field to Sea. (192 pp.) London: Offices of "Country Life," 1919. 6s. net. [63.14(02).]

History of the Navigation of the Port of King's Lynn and of Cambridge; also the History and the Present State of Draining in the Bedford Level. Illustrated with Maps. (148 pp.) London: L. Davis & C. Reymers, 1766. [63.14(02).]

Economics—

Spain, Ministerio de Fomento.—Estatuto de la Mutualidad Nacional del Seguro Agropecuario. (16 pp.) Madrid, 1919. [368.5.]

Hibbard, B. H.—Effects of the Great War upon Agriculture in the United States and Great Britain. (232 pp.) New York and London: Oxford University Press, 1919. [63.73; 63.08.]

Eve, Sir H. Trustram.—State Control and Agriculture. (113-151 pp.) ["Journal of Farmers' Club," December, 1919.] 6d. net. [338.99.]

Selley, E.—Village Trade Unions in Two Centuries. (183 pp.) London: George Allen & Unwin, 1919. 4s. 6d. net. [331.]

SELECTED CONTENTS OF PERIODICALS.

Horticulture—

Les Plantes médicinales à Valenciennes, *Ardouin-Dumazel*. (Jour. d'Agric. Prat., 7th August, 1919.) [63.348.]

Über die Zusammensetzung von Gemüse und Gemüseabfall, *M. F. von Schleinitz*. (Landw. Jahrb., LII. Bd., Hefte 2 & 5, 1918.) [63.51(04).]

Plant Diseases—

Burgundy Mixtures and other Copper Sprays, *G. T. Spinks*. (Ann. Rep. Agric. and Hort. Research Sta., Long Ashton, 1918.) [63.295.]

Silver Leaf Disease, III. (Including Observations upon the Injection of Saps with Antiseptics), *F. T. Brooks* and *M. A. Barley*. (Jour. Agric. Sci., September, 1919.) [63.24-41.]

Silver Leaf Disease, *J. Bintner* (Roy. Bot. Gard., Kew, Bull. No. 6 and 7, 1919.) [63.24-41.]

The Fungicidal Properties of Certain Spray-fluids. II, *J. V. Eyre*, *E. S. Salmon* and *L. R. Wormald*. (Jour. Agric. Sci., September, 1919.) [63.295.]

Skin Spot Disease of Potato Tubers (caused by *Oospora pustulans*), *M. Nest Owen*. (Roy. Bot. Gard., Kew, Bull. No. 8, 1919.) [63.24.]

Note on Striped Pine Caterpillar (*Trachea piniperda*). (Tijds. Ned. Heidemaatschappij, October, 1919.) [63.27.]

Versuche mit Saatschutzmitteln. *H. C. Müller* and *E. Mols*. (Landw. Jahrb., LII. Bd., Heft 1, 1918.) [63.294.]

The Anatomy of the Head and Mouth Parts of *Psylla mali*, the Apple Sucker, *A. J. Grove*. (Parasitology, October, 1919.) [63.27.]

Rhizoctonia Disease, or Stem Rot, on Potatoes, *D. G. O'Brien*. (Scott. Jour. Agric., October, 1919.) [63.24.]

A Dry Method of Treating Seed Wheat for Bunt, *G. P. Darnell Smith* and *H. Ross*. (Agric. Gaz., N.S. Wales, October, 1919.) [63.24.]

Live Stock—

Über Chenopodiaceen als Nahrungsmittel, besonders über die als Melden bekannten Arten von Chenopodium und Atriplex. Ein Betrag zur Frage der Verwendung der peruanischen Reismelde, Chenopodium Quinoa, *Dr. F. W. Bach*. (Landw. Jahrb., LII. Bd., Heft 3, 1918.) [63.259; 63.604(a).]

The Nutritive Value of Feeding Stuffs, *J. Alan Murray*. (Science Progress, October, 1919.) [612.391.]

Problems of Animal Breeding, *J. A. S. Watson*. (Scott. Jour. Agric., October, 1919.) [63.603.]

Scottish Pure-Bred Live Stock. I.—Aberdeen-Angus Cattle, *James R. Barclay*. (Scott. Jour. Agric., October, 1919.) [63.62.]

The Use of Poppy Seed Cake as a Cattle Food and its Effect on Yield of Milk and Composition of the Butter Fat, *H. E. Annett* and *J. N. Seu*. (Jour. Agric. Sci., October, 1919.) [63.604(a).]

Die Künstliche Trocknung und Verfütterung der Brennnessel, *O. Fischmann*. (Deutsche Landw. Presse, 20th August, 1919.) [63.604(a).]

Sesbania—A Feeding Stuff from South Africa. (Bull. Imp. Inst., Vol. XVII., No. 2, April-June, 1919.) [63.604(a).]

The Seed-Crushing Industry, *J. W. Pearson*. (Jour. Roy. Soc. Arts, 12th December, 1919.) [63.604(a); 664.3.]

Die Strohaufschliessung nach dem Beckmannschen Verfahren. I.—Einfluss der Aufschliessungszeit auf den Umfang der Nährwerterschliessung. *G. Fingerling* and *K. Schmidt*. (Land. Versuchs-Stationen, Band XCIV., Heft 3 and 4, 1919.) [63.604(a).]

Engineering—

Pöhl Motorpflüge. (Deutsche Landw. Presse, 27th August, 1919.) [63.175.]

Hand Broadcasting Machine, *Hoffmann*. (Deutsche Landw. Presse, 29th October, 1919.) [63.17(04).]

Economics—

Zur Entwicklung der Landarbeiterlöhne in Preussen, *Dr. W. Asmis*. (Landw. Jahrb. LII. Band, Heft 4, 1919.) [331.]

Costs of Production and Horse Labour, *H. W. Carlton*. (Jour. Land Agents' Soc., November, 1919.) [338.58.]

Supplement
TO
The Journal
OF THE
BOARD OF AGRICULTURE.

SUPPLEMENT No. 18. MARCH, 1919.

**The Cultivation, Composition
and
Diseases of the Potato.**



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SUPPLEMENTS TO THE JOURNAL OF THE BOARD OF AGRICULTURE.

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INDUSTRY OF ENGLAND AND WALES
II THE COST OF MILK PRODUCTION | SEPT., 1916 |
| No. 17.—GRASS LAND AND PLOUGHED LAND | MAY, 1917 |

IN view of the great importance of the potato crop, and of the fact that reports on last year's work on tests of varieties for immunity from Wart Disease and on the effects of Spraying were ripe for publication, it was considered that a useful purpose would be served if the reports, together with other papers on potatoes, their cultivation and diseases, were brought together under one cover. The preparation of this Supplement was accordingly undertaken. It is hoped, however, that the collection of papers will prove of value to growers of potatoes, whether on a large or a small scale.

BOARD OF AGRICULTURE AND FISHERIES,

LONDON, S.W. 1.

March, 1919.

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The Cultivation, Composition & Diseases of the Potato.

POTATO GROWING.

THE VALUE OF THE POTATO.—Of the crops, other than cereals, which exercised an important influence on the course of the War, the potato is the chief ; indeed, in some ways the potato may be said to have been the most important of all crops, for without it Germany could not have carried the War into the fifth year.

With the single exception of sugar beet, more human food per acre can be produced by the potato than by any other of our commonly cultivated plants, and whereas the sugar beet must go through a process of manufacture, and sugar, when produced, can only be employed as a relatively small component of a mixed diet, the potato may be used direct as a principal article of food. During the War, for example, the potato has formed from one-third to one-fourth of the diet of the German civilian population.

The uses of this crop have long been recognised in Germany, and that country grew a very much larger quantity of potatoes than was needed for direct consumption by the people. The crop was employed in stock feeding, all classes of stock, especially pigs, receiving potatoes as part of their regular winter food. To a less extent the crop was used in distilling, starch manufacture and in the preparation of dried potatoes. After the outbreak of war there was a great shrinkage in the German supplies of cereals, and human food was secured by reducing live stock and providing more potatoes (especially in 1915 and during the winter of 1917-18) for direct consumption.

In illustration of the important position taken by the potato among German food crops it may be stated that, before the War, while the average 100 acres of British cultivated land included less than 2 acres of potatoes, the average 100 acres of German cultivated land included 10 acres under this crop.

Further, in illustration of the quantity of human food produced by the potato the following figures may be given. The figures show the number of persons who could be supported

for a year on the produce of 100 acres of the crops named. The crops are assumed to be average British crops. In the case of potatoes two sets of figures are given, showing the results that would be obtained (i) if the crop were fed to human beings, as it chiefly is in Britain, and (ii) if fed half to human beings and half to pigs, as in Germany before the War. It is, in all cases, assumed that the foods form part of a properly blended diet.

100	acres	potatoes	support	..	..	..	420	persons.
50	"	"	used direct support	210	persons	} 255	"	"
50	"	"	fed to pigs support	45	persons..			
100	"	wheat	used direct support*	..	..	230	"	"
100	"	barley	used direct support*	..	..	180	"	"
100	"	oats	used direct support*	..	..	155	"	"
100	"	medium grass,	producing beef	..	..	15	"	"

* Offals fed to cattle.

There has been a disposition in the past to underrate the dietetic value of the potato, and, while admitting that it was a useful cheap food, to regard its nourishing properties as low. Those who have remarked the results produced by potatoes when used in combination with oatmeal by the Scottish or Irish peasantry have been sceptical as to this popular reputation of the tuber, and recent scientific work has shown that the nitrogenous constituents of the potato have, in fact, a much higher dietetic value than has hitherto been supposed.*

In public lectures given under the auspices of the German Council of Agriculture in Berlin in 1917, great claims were advanced on behalf of the potato as an article of diet and as a substitute for butcher's meat; but no experimental evidence in support of these claims was given, and it would be as unwise to exaggerate the food value of the potato as hitherto it has been to underrate it.

The chief disadvantages of the potato as a food crop are that it is bulky, and calls for extra transport just when the railways are busiest; that it does not keep well after April; and that when there has been much disease in the growing crop there is a heavy wastage even earlier in the year. To some extent, too, the crop is an uncertain one, but this is now much less the case than formerly owing to the number of varieties in cultivation. The 1916 crop was the only bad failure in recent years, and even in that season many districts grew quite satisfactory crops.

On balance, having regard to the ease of cultivation, the very high yield of human food produced, the quality of the potato as fodder for live stock if not required by man, its value

* See article on "The Food Value of the Potato Crop," p. 23.

as a cleaning crop, its suitability for planting on newly-broken grass land (especially on land too rich for corn growing), its usefulness for small fields in thickly-populated districts or near villages where sparrows would do great damage to grain, and the fact that a good crop may be secured in most parts of the country even if planted as late in the season as the beginning of May, the potato must be regarded as the most valuable of all our spring crops and, indeed, a close second to autumn-sown wheat.

After the sowing of autumn wheat has been finished every effort should be made to secure the largest possible acreage of the second best crop—potatoes.

CULTIVATION.—As a farm crop potatoes are grown to a greater or less extent on practically all kinds of soil except heavy clays or on wet, undrained land, but deep, rich sandy loams, such as the red soil of East Lothian, or well-drained alluvial silts, such as the "Warp" lands of Yorkshire and Lincolnshire, are best adapted for the crop. Fen or peaty soils if well drained are also suitable, though the quality of tubers produced on such land is not quite so good. Like carrots and rye, potatoes can be grown on the very lightest sands, and on such soils the quality of the tubers is usually high and the cost of cultivation is comparatively small. There is no fixed rule as to the position potatoes should occupy in the rotation. In special cases, *e.g.*, the early potato districts of Ayrshire and Cornwall, they are grown on the same land year after year, autumn catch crops such as broccoli, rape or Italian rye-grass being the only change given. In other cases, *e.g.*, the Fen districts or on the red soil of Dunbar, they may be taken every three years, but in ordinary cases they occupy part of the root "break" and usually follow a corn crop. It may, however, be pointed out that potatoes do exceptionally well after a temporary ley or old grass, and, where conditions are suitable, potatoes should be taken on at least part of any area of good grass land which is to be broken up. After really good grass the land is usually in too high condition to grow corn satisfactorily, and with proper cultivation the decaying sod provides ideal conditions for potatoes.

In any circumstances potatoes demand a deep, friable tilth, though a very fine condition of soil is not essential. So long as the seed is well covered there are good opportunities for working the soil after the potatoes have been planted, and in fact, within limits, the more thorough the cultivation after planting the better. When potatoes follow a corn crop the cultivation is similar to that for an ordinary root crop and

should begin with an autumn cleaning followed by a deep winter ploughing, with suitable cultivation in spring to secure the necessary tilth. The cultivation of leys or old grass in preparation for potatoes is not so common, and as an extension of this practice is most desirable, mention may be made of the various ways found satisfactory.

In the case of a temporary ley, one, two or three years old, or an exceptionally well-grazed old pasture, there is no special difficulty. As a rule the land is ploughed quite shallow in autumn and left until early spring, when a deep cross-ploughing is given, a skim coulter being used to turn the sod to the bottom of the furrow.

If farmyard manure is to be given it is best applied on the grass before the first ploughing. If it is left to be applied in the rows these will have to be made so deep that a good deal of the turf will be brought to the surface, and cause trouble in the subsequent cultivation.

In specially favourable conditions, as in the case of a deep, uniform sand or light loam, one deep ploughing with a digging plough fitted with a good skim coulter may be sufficient. A better practice, however, is the "double ploughing" adopted on the deep alluvial soils of Lincolnshire and other districts, even where the grass is really old and not merely the comparatively loose, open turf of a temporary ley. Two ploughs follow each other; one takes off the sod to a depth of 3 in. or 4 in., turning it into the bottom of the deep furrow previously left by the second plough. This in turn throws the soil to a further depth of 8 in. or 9 in. on to the top of the shallow furrow, which is thus effectually buried and is not brought to the surface by any subsequent cultivation.

Where such a method cannot be adopted, owing either to the roughness of the sod or the shallowness of the soil, the preparation for potatoes presents more difficulties. Under such conditions a disc harrow is a most useful aid at all stages. In some cases the sod may be thoroughly cut up by repeated disc-harrowings before it is ploughed, and if the work has been well done a deep ploughing will be all that is required to prepare for the usual spring cultivation. Where a particularly thick, tough sod is encountered the land should be ploughed shallow in early autumn and heavily rolled immediately afterwards. During winter the sod should be torn to pieces as thoroughly as possible by repeated harrowings, disc-harrowings and whatever other operations are found to have the desired effect. Having achieved the object in view, a deep ploughing should

be given, and it is desirable to complete this in time to allow the raw soil to mellow and weather before planting-time. In the first ploughing of such land a disc coulter will be found almost indispensable, as the rough sod drives in front of an ordinary coulter, accumulates under the beam and either forces the plough out of the ground or slips on one side in a mass which the plough cannot cover.

Taking everything into account it is best to aim at getting the land into such a state that it can be ridged and the potatoes planted in rows, but good results are sometimes obtained by dibbling potatoes on land ploughed just as it would be for corn. or, in the case of land ploughed early, by planting the tubers in the bottom of every third furrow at the time of the second ploughing in spring. In such circumstances the tubers should be placed under the shoulder of the previous furrow slice so as to escape damage by the feet of the furrow horse. On a small scale the lazy bed system may be useful, particularly where the drainage is not good, though it is not advisable to attempt to grow potatoes at all on a really badly-drained soil.

The advantage of having potatoes in drills is particularly marked in the case of foul soils. Given good weather conditions, much can be done to clean the land before the young shoots appear. The usual process consists in harrowing down the ridges with either "saddleback" or chain harrows, scuffling or grubbing between the rows and then earthing up with a ridging plough. This series of operations is repeated as often as is thought desirable until the potatoes are just appearing at the surface, and the result is not only suppression of weeds at a comparatively small cost but the reduction of the soil to a fine uniform tilth, even if it was in a rather rough condition when the crop was planted. If good seed of a strong, vigorous variety has been selected, and the manuring is adequate, further cleaning will soon be impossible and unnecessary, as no crop in general cultivation is so well able to smother out weeds of all kinds as a really good crop of potatoes.

MANURING.—Probably no crop grown on the farm receives more manure than the potato crop. Though, in most cases, the plant responds readily to liberal manuring, it is doubtful if it is a greedier feeder than other "fallow" crops. It should be borne in mind that the largest possible crop is not always the most profitable, and that an excess of manurial ingredients over the requirements of the crop may lead to considerable waste.

Dung Alone.—In manuring potatoes a certain amount of dung is always beneficial except possibly when the crop is

taken after really good grass. It may be applied at different periods of the year. In the drier districts autumn or winter applications are to be preferred; elsewhere spring applications generally give the best results. A dressing of 20 tons of dung per acre is not uncommon, and with this alone good crops may often be obtained. It frequently happens, however, that the foliage is encouraged at the expense of the tubers, especially when nitrogenous artificials are also applied, and actually heavier and more profitable crops can be grown by using half the above quantity of dung with artificials. If the land is in very poor condition, 20 tons of dung may prove more profitable than 10, but in most cases the former quantity of good manure is too large to be applied with profit.

Dung Supplemented with Artificials.—The most common system of manuring potatoes is to apply a moderate dressing of dung—say about 10 tons per acre—and supplement it with artificials.

The following mixture of artificials per acre may be recommended as a safe and reliable one under most circumstances, and no farmer should use artificials in greater quantity along with 10 tons of dung until he has thoroughly satisfied himself by experiment that it can be done with profit:—

1 cwt. sulphate of ammonia.

2 to 3 cwt. superphosphate.

1 cwt. sulphate of potash, or equivalent quantities of blast furnace flue-dust,* if available.

This mixture will contain 4 to 5 per cent. of nitrogen (equal to 5 to 6 per cent. of ammonia), 13 to 15·6 per cent. of soluble phosphates and 10 to 12·5 per cent. of potash.

Under present conditions from 1 to 1½ cwt. of sulphate of ammonia and 3 to 4 cwt. of superphosphate may be used in the normal dressing stated above. If the full allowance of superphosphate is not obtainable a smaller quantity should be supplemented with steamed bone flour or ground mineral phosphate; or 4 to 5 cwt. per acre of a highly-soluble slag may constitute the sole phosphatic dressing.

In the case of early potatoes, with a comparatively short period of growth, 1½ cwt. of sulphate of ammonia may be given in addition to the phosphatic manure mentioned above.

* See Food Production Leaflet No. 23, "Blast Furnace Flue-Dust as a Potash Manure." For the present potash is scarce and very expensive, and the quantities indicated above should only be used (even if available) in cases in which the grower has proved that full supplies of potash are essential for his crop. In other cases half the quantity should be used.

The Effect of Artificiala when no Dung is Applied.—Though dung is generally regarded as essential in the manuring of potatoes, very good and highly profitable crops can be grown without it.

The following mixture of artificiala per acre may generally be depended upon to produce as big a crop of potatoes as would 10 tons of dung :—

2 cwt. sulphate of ammonia.

5 „ superphosphate.

2 „ sulphate of potash, or equivalent quantities of blast furnace flue-dust, if available.

The mixture will contain 4.4 per cent. of nitrogen (equal to 5.3 per cent. of ammonia), 14.4 per cent. of soluble phosphates and 11.1 per cent. of potash.

As before, if the full allowance of superphosphate cannot be given, as much as possible of this manure should be used, and the deficiency made up with either steamed bone flour or ground mineral phosphate; or 6 cwt. of highly-soluble basic slag may be the sole phosphatic dressing. (Sulphate of ammonia should not be mixed with basic slag or mineral phosphate.)

Dung, when readily obtainable, will doubtless prove more economical than the above mixture of artificiala, but there are times—*e.g.*, after grass—when such a mixture alone will give quite as profitable returns as will 10 tons of dung.

Sulphate of Ammonia v. Nitrate of Soda.—When used with dung there is generally little to choose between these two sources of nitrogen in regard to the yield of the crop, but when no dung is used the results are mostly in favour of sulphate of ammonia. It is possible that, in the absence of direct supplies of potash, nitrate of soda may give the better results.

Calolum Cyanamide and Nitrate of Lime.—Experiment has shown that these fertilisers are about equal in value, nitrogen for nitrogen, to sulphate of ammonia.

Different Potash Manures.—Sulphate of potash will, in most cases, give the best results, but there is so little to choose between the sulphate and the muriate that a farmer should be guided by their respective unit prices at the time of purchasing.

Both these forms have proved superior to kainit. There is an idea prevalent amongst farmers that kainit, owing to its attractive power for moisture, is superior to the other forms on sandy or light soils, especially in a dry season. This, however, does not appear to have been borne out by experiment.

In view of the small stocks of these manures at present available in this country the supplies of potash required will have to be obtained as far as possible from other sources. On rich loams, on the heavier classes of soils generally, and in the Fens, potash manures will not be greatly needed if an average dressing of farmyard manure or (in certain districts close to the sea) seaweed can be applied. One ton of farmyard manure or 12 to 13 cwt. of seaweed contain on an average about as much potash as 1 cwt. of kainit. Even when supplies of farmyard manure are available, however, the lighter classes of soils are often greatly benefited by a small quantity of potash in the form of artificial manure. Limited quantities of a potash manure obtained from the flue-dust of blast furnaces are now on the market, and should be reserved for potatoes on such light soils as are known to respond to potash manure. Potash may also be purchased in the form of Peruvian guano, many samples of which contain from 2 to 3 per cent. Assuming a sample to contain 8 to 9 per cent. of nitrogen, 25 to 30 per cent. of phosphates and 3 per cent. of potash, 4 cwt. per acre would give approximately the same amount of potash as 1 cwt. of kainit and, where dung is applied, an ample amount of nitrogen and phosphates.

SELECTION AND TREATMENT OF SEED.—In the cultivation of potatoes the importance of good “seed” cannot be over-emphasised.

With all crops the proper selection of seed is essential to success, but in growing potatoes it is of prime importance. The variety, origin and treatment of the seed often have a greater influence than methods of cultivation, manuring, etc., and neglect to pay proper attention to these points may nullify the care, labour and money expended on cultivation and manuring.

Choice of Variety.—Potatoes vary greatly as regards cropping capacity, cooking quality, disease-resisting power and earliness. Care should be taken to select varieties which suit the conditions under which they are to be grown, and the purpose for which they are intended. The number of varieties in cultivation is large, and as old sorts gradually lose vigour they are continually being replaced by new. It is impossible to mention more than a few of the well-known varieties, but from these a selection might be made to suit almost any conditions or market. It is, perhaps, necessary to add that the same variety is often sold under several different names. In the

following notes the best known varieties of each type or group are mentioned.

First Earlies.—*May Queen* and *Duke of York* are two favourite varieties for garden cultivation. They are very early and of good quality, but their cropping power is rather low, and, under present conditions, the area devoted to them should not be great. Some varieties of maincrop potatoes keep quite well until the end of June, and heavier cropping earlies than those mentioned above are ready for lifting after that time.

Ninety-fold is a heavy-cropping variety, and is grown largely for marketing purposes, though the tubers are rather watery and readily suffer from handling. It is fairly early, and should be lifted in good time, as it is very susceptible to ordinary potato disease.

Epicure is grown more extensively on a field scale perhaps than any other early variety. It produces heavy crops, is reasonably early, and a large proportion of the tubers, even when lifted early, are of marketable size. It resists potato disease well, but should, as a rule, be marketed in good time, as the tubers, if left to mature, are apt to become rough and coarse, and are not then readily disposed of. In such cases either *Ninety-fold* or *Eclipse*, or *Sharpe's Express* should be grown in preference to *Epicure*.

Sharpe's Express is a little later than *Epicure*, but is a good cropper, and the kidney-shaped tubers are of excellent quality. If lifted too early a large proportion of the crop will be small, but where extreme earliness is not required the variety can be recommended.

Eclipse is one of the heaviest cropping early varieties, and has fair quality and disease-resisting power. It is a little doubtful whether it should be classed as a first or second early, but at the present time, when weight of crop should not be sacrificed to extreme earliness, it should occupy ground devoted to first earlies rather than to later varieties.

Second Earlies.—*British Queen* has in recent years become so susceptible to attacks of potato disease that it has lost favour to a great extent, but it is still the most important second early in cultivation. For combination of cropping power and cooking quality it cannot be beaten, but the crop should be lifted comparatively early to avoid loss by disease.

Great Scot, a white, round variety, produces very heavy crops, and as it is resistant to wart disease it has assumed an

important position in recent years. Owing to the limited supply of seed and the necessity of providing for the needs of infected areas, it is not recommended for general cultivation this year. It is important to bear in mind the fact that while Great Scot is not affected by wart disease it is not immune from ordinary potato disease. On this account it should be lifted comparatively early.

King George V, like Great Scot, is resistant to wart disease, and practically all the available seed will be required for growth in infected areas. It resists ordinary potato disease well, but is usually considered to be of inferior cooking quality.

Royal Kidney has the advantage over British Queen in that it resists potato disease extremely well and is also a good cropper, but the cooking quality is poor.

Mid-Season or Early Maincrop Varieties.—*King Edward*, *Evergood* and other varieties are sometimes regarded as second earlies, sometimes as later varieties, but it is perhaps better to class them separately. *King Edward* is a well-known oval potato with pink patches. It produces heavy crops of good quality when grown on deep rich and rather moist land, but is apt to be disappointing under dry conditions. It is not resistant to potato disease and should be lifted comparatively early, though the tubers if properly stored keep very well.

Evergood is a heavy cropping variety almost entirely resistant to potato disease, but the tubers are of such low quality that the variety can only be recommended for sale in markets where quality is a secondary consideration, or under conditions where resistance to disease is all-important.

Maincrop or Late Varieties.—*Arran Chief* is a comparatively new variety which has done well in recent years. The crop produced is as a rule heavy and the tubers, though apt to be rather rough and ill-shaped, are of excellent cooking quality. It is not particularly resistant to potato disease but is better in this respect than Up-to-Date, which it is now largely replacing. The tubers are round and, as in the case of many round varieties, are sometimes hollow.

President is a favourite in some districts where resistance to disease is of great importance. The quality is very fair, and provided that fresh seed is obtained the crops are almost invariably heavy, but this variety is particularly subject to leaf curl, and, to be on the safe side, seed fresh from Scotland or the North of Ireland should be purchased every year.

Up-to-Date, with which may be included a large number of similar varieties, such as *Dalhousie*, *Factor*, and *Dalmeny Beauty*, was until a few years ago by far the most important maincrop variety. In recent years, however, it has become so subject to potato disease that the area devoted to it is being rapidly reduced. Where disease does not occur it is still strongly recommended; the quality is excellent and the yield good.

Langworthy, *Golden Wonder* and *What's Wanted* belong to an old class of potatoes grown largely on account of their high quality. Both tubers and crops are apt to be small unless conditions are very favourable, and the varieties now are noteworthy mainly because they resist wart disease.

Irish Queen is a round, deep-eyed, pink-skinned variety which also resists wart disease, and may be relied on to produce fair crops which will keep well.

Lochar and *Templar* are two new varieties resistant to wart disease. The supply of seed is not great, and will practically all be required for planting in infected areas.

Wart Disease and Choice of Variety.—Where wart disease has occurred, only those varieties proved experimentally to be resistant to the disease should be planted. When immune varieties are planted, excellent crops of sound tubers can be obtained from badly-infected land, but only disaster can result from planting varieties susceptible to this disease. (See also pp. 68–102.)

Change of Seed.—Too much stress can hardly be laid on the importance of securing new seed from a district known by previous experience to give a good change. For most districts in England and Wales, seed from Scotland or the North of Ireland gives the best results, and, as a rule, the farther north the district from which the seed is obtained the better the results, but the altitude of the farm on which the seed was grown has an important effect. For instance in tests carried out in North Wales, seed grown at 900 ft. above sea level in Midlothian produced slightly heavier crops than seed grown at about sea level in Aberdeenshire or Sutherland. On the other hand, seed from similar elevations in Sutherland, Aberdeenshire, and Forfarshire, produced crops of 16 tons 16 cwt., 14 tons 19 cwt., and 14 tons 8 cwt. respectively.

Farmers in hill districts might with advantage bear the effect of altitude in mind with a view to developing a trade in seed potatoes with growers on low ground.

Results of experiments which have clearly shown the advantages of obtaining fresh seed could be quoted almost in-

definitely, and the extensive trade in seed potatoes from Scotland and the North of Ireland is clear evidence of the importance attached by potato growers to the effect of a change, but the following cases, typical of many others, may be mentioned.

In North Wales, at 14 farms, new seed from the North of Ireland was tested against "once grown" seed and against seed grown at least two years on the farm. In all cases the variety was the same—Up-to-Date. The average crops from the three classes of seed were as follows :—

	<i>Marketable.</i>		<i>Small.</i>		<i>Diseased.</i>		<i>Total.</i>	
	T. cwt.		T. cwt.		T. cwt.		T. cwt.	
New seed	10	16	1	13	0	12	13	1
Once-grown seed ..	9	0	1	3	0	18	11	1
Twice-grown seed ..	7	13	1	4	0	16	9	13

These results show clearly the usual effects of a change of seed. The new seed gives a more vigorous crop, which resists disease better than that grown from old seed ; the total crop is much greater, but the average size of the tubers is rather less than in the crop grown from old seed.

In the southern counties it is always advisable to change seed after the second year, and, in some localities, every year, especially after a hot, dry summer. Garlorth experiments have shown also that as far north as Yorkshire it may be profitable to change the seed after the *second* year. Crops of British Queen and Conquest, grown for three years in succession on the farm, produced, on the average, 2 tons 1 cwt. *less* than crops of the same varieties grown only two years, and included many more diseased tubers.

It may be pointed out that new seed should be obtained as early in spring as possible, before sprouting has commenced, so that the damage which sprouted potatoes suffer in course of bagging and transit may be avoided.

STORING OF SEED.—During recent years different methods of storing seed have been tested, and it has been found possible by introducing suitable systems of storage to produce considerable increases in crop.

Boxing in Autumn.—According to this method, which has been largely adopted for some years by the growers of early potatoes, seed-size tubers are placed in the autumn in shallow boxes containing no soil or other material, and stored throughout the winter in tiers in a cool, well-ventilated and well-lighted shed. No artificial heat need be used, except in frosty weather, when a small paraffin stove or large lamp should be placed in

the shed to keep the temperature above freezing point. From time to time the order of the boxes in the tiers should be reversed so as to ensure an equal amount of light to all the potatoes. This treatment leads to the "greening" of the tubers and the development of short, sturdy, green sprouts, which do not break off during planting, and the crop gets an "early start." Further, experiments conducted at Kew showed that "greened" tubers lose only about one-sixth as much in weight during the season as those not "greened," and are therefore firmer; while "greening" will to a great extent check the ravages of winter rot. The method, however, involves a good deal of labour at a time when work presses, and, further, accommodation for boxes is often lacking on farms at this season of the year.

Boxing in Winter or Early Spring.—Second early or late varieties may be clamped or "pied" straightway in autumn and transferred to boxes in winter or early spring, whenever weather conditions are suitable and men can be spared for the work.

In some cases quite as good crops have been grown from seed stored in this way as from that boxed in autumn, but in general it is less satisfactory to box in winter and early spring than in the autumn.

A very convenient box is that illustrated below. It holds from 16 to 20 lb. of seed, and from 100 to 120 boxes will be

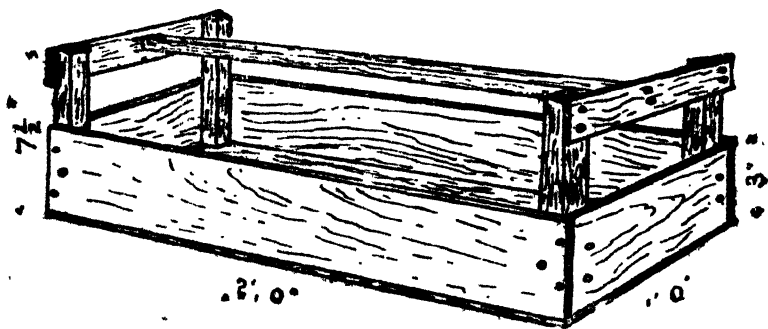


FIG. 1.—Box for sprouting seed potatoes.

required per acre. Before the War the boxes cost 4*d.* to 5*d.* each, and as they last for several years the annual cost per acre was not great.

Pieing in Autumn and Planting Direct from the Pie.—Both of the methods just described have proved superior to the ordinary one of planting direct from the pie. Even with late varieties,

if the potatoes taken direct from the clamp are planted so late that sprouting has taken place before planting time, the results with boxed seed will almost invariably be better. In a Yorkshire experiment carried out in 1903 with Up-to-Date, an advantage of two tons per acre followed the use of boxed seed. In 1904, five varieties (second early and late) showed an advantage of 33 cwt. per acre in favour of boxed seed. In 1905 an average increase of one ton per acre was produced at Garforth by seven varieties when boxed seed was used.

In each year these results were obtained from Scotch seed introduced into Yorkshire in the previous season, and, as might have been expected, excellent crops were obtained without any special treatment. Even with such seed, however, boxing resulted in a profitable increase.

In each of the above trials the potatoes were planted in May. Further experiments appear to show that the advantages of boxing are not so great in districts where planting is possible about the end of March or the beginning of April.

Where large areas of potatoes are planted it is difficult to provide sufficient boxes for the seed, or accommodation for the boxes, but it should at least be possible to box the earlier varieties. If it be found impracticable or unnecessary to box the seed of late or main-crop varieties, which do not sprout in the pies to the same extent as the early varieties, it is, perhaps, better to spread the seed some time in early spring in a thin layer on the floor of a dry, well-lighted shed, than to leave it in the pie till planting time.

The free admission of light is important. It has the effect of producing a slow, sturdy growth of sprouts which are much less liable to be knocked off at planting time than the pale, elongated sprouts produced in the dark.

In addition to minimising the damage to sprouts, early removal of the seed from pies is beneficial for another reason. Rotting frequently takes place in the pie, sometimes to a serious extent; and sprouts which have come into contact with rotten tubers are often considerably damaged, and not infrequently killed. Rotting may be checked by dusting the tubers freely with quicklime before pieing. Lime used in the "quick" form readily becomes detached from the tubers in spring, leaving them clean and dry. Slaked lime should not be used, as it adheres to the tubers in a pasty condition, and on drying becomes firmly attached to them. Sprinkling the tubers with powdered sulphur at the rate of 2 lb. per ton of tubers also holds winter rot in check.*

* See also Leaflet No. 193, "Dry Rot of Potatoes."

Small Compared with Large Seed.—In many parts of the country it is the practice to plant small tubers, *e.g.*, those which will pass through a $1\frac{1}{8}$ in. riddle but not through a $1\frac{1}{4}$ in. riddle, all the bigger ones being sold for cooking purposes. Other growers prefer large seed and have their seed dressed through a 2 in. or even a $2\frac{1}{4}$ in. riddle. In discussing their cropping capabilities, two kinds of small potatoes must be considered: (1) the late-formed tubers of strong, robust plants, and (2) the produce of plants of low vitality. If the bulk of the seed consists of the former, then quite satisfactory returns may be obtained, as the tubers are small simply on account of their having had insufficient time to reach full size; if the seed, however, be the small, stunted produce of weakling plants, only weakling tubers can be expected from them, practically all of which will be of "seed" size. Whilst it may be possible, therefore, to obtain a good crop the first year from small seed, owing to the likelihood of the seed consisting largely of tubers formed late in the season, the chances are that if seed from the same stock be used for a number of years in succession, an ever-increasing proportion will be the produce of weakling tubers, with the result that the returns will become more and more unsatisfactory.

Experiments have shown that tubers about the size of a hen's egg generally prove the most profitable for planting purposes, but when supplies of seed are scarce and dear there need usually be no hesitation in planting somewhat smaller tubers provided they are the produce of a uniformly vigorous crop, or have been grown in a cool, northern climate.

Whole Compared with Cut Seed.—Should the supply of whole seed run short, the deficiency may be made good by cutting large tubers. In this case the weight planted per acre may be considerably greater than when seed-size potatoes are planted whole, but, on the other hand, the produce will generally contain a less proportion of "small" tubers than the produce of whole seed. Planting should be done directly after cutting, and the sets covered in with as little delay as possible. Exposure even during the dinner hour may be sufficient materially to reduce the yield from cut sets. If for any reason it is impossible to plant immediately after cutting, the cut surface should be dusted with quicklime.

PLANTING. Time of Planting.—Potatoes should be planted in spring, as soon as a good tilth can be obtained. April is generally a suitable month, but planting is sometimes possible towards the end of March, while good returns are not infrequently obtained from seed planted in May. When, however, no

special precautions—such as boxing—are taken to preserve the first sprouts, it is advisable to plant the potatoes so that they shall, as far as possible, make their first growth in the soil. A good covering of soil will protect the sets from frost, even when planted as early as the end of March, but as soon as the weather becomes fairly mild, part of the covering should be removed by harrowing, as weak and spindling sprouts result if they have to push their way through a considerable thickness of soil before reaching the light.

Depth of Planting.—As to the proper depth to plant, a great deal depends upon the character of the soil. Where the soil is loose and friable it is possibly advantageous to plant fairly deeply. When dung is applied in the row the danger of the sets being covered too much is minimised, but when potatoes are planted without dung in the row there is considerable risk of their being covered too deeply, especially on the heavier class of soils.

Distance Apart.—The width between the rows, and the distance between the sets in the rows, also depend upon local conditions, but in general 26 in. between the rows and 15 in. between the sets will prove satisfactory. On the other hand, on some soils and in some localities 12 in. between the sets has yielded a better crop.

In the case of first early varieties the distance between the rows may be 20 to 24 in., and between the sets in the row, 10 to 12 in.

SPRAYING.—The object of spraying potatoes is to reduce the loss caused by the ordinary potato disease or blight (*Phytophthora infestans*),* and at the outset it must be made clear that the extent of the damage done by this disease cannot be measured simply by the proportion of tubers found to be diseased when the potatoes are lifted. The disease first makes its appearance on the leaves, usually about the end of July or beginning of August, and if the variety grown is not one which resists the disease, and if other conditions are suitable—particularly if the weather is moist and warm—the whole of the haulms may be killed off in a few weeks, with the result that, instead of growth extending well into October, no addition to the weight of tubers takes place, after say the beginning of September. The result of this is that the weight of crop is less than it would otherwise have been, and the proportion of small tubers is large. Whether the proportion of diseased tubers is large or not will depend very much on the weather after the potatoes have been attacked. If the weather continues

* See pp. 28 and 63.

to be wet, a large proportion of the tubers will be diseased when lifted. If, on the other hand, September and October are dry and hot, the proportion of diseased tubers may be small, but none the less, owing to the reduction of the crop, serious loss may have been caused. Put briefly, it may be said that under certain conditions potato disease may have caused very serious damage, even though hardly a diseased tuber is found when the potatoes are harvested.

It need hardly be said that climate has a good deal to do with the occurrence of the disease, and, particularly in the moist and mild western districts of England and Wales, the annual loss caused is very great.

The effect of spraying has been thoroughly tested during the last 16 years in North Wales and the following average results of experiments conducted at 91 centres in North Wales in the years 1901-1915 may be quoted :—

		Average Weight of Potatoes per Acre.			
		Marketable.	Small.	Diseased.	Total.
		T. cwt.	cwt.	cwt.	T. cwt.
Sprayed	.. ..	10 6	18	11	11 15
Unsprayed	.. ..	8 12	21	15	10 8

The figures show clearly the effect of spraying. The proportion of diseased tubers is less where spraying has been done than in the untreated crop, but probably the difference between the proportion of diseased in the two sets of figures is less than many people would expect. If, however, the weights of marketable potatoes are considered, the full results of the spraying are evident. The spraying has prolonged the growth, and thus resulted in a much greater crop of marketable potatoes, the average increase being 1 ton 14 cwt. per acre.

Consideration of the effects of the disease, as briefly indicated above, shows that it is quite possible for spraying to have proved successful, even though there are almost as many diseased tubers in the sprayed crop as in the unsprayed crop.

TIME TO LIFT POTATOES.—It is highly important that potatoes should be lifted as soon as they are ripe. It has been demonstrated repeatedly that, if attention is given to this point, comparatively healthy crops can be obtained even from those varieties which are generally regarded as being very liable to disease.

FORMATION OF THE PIT.—The general principles on which a pit or pie or clamp is made are practically the same throughout the country.* The method of covering, however, varies considerably, but the following may be safely recommended. The usual roof-shaped pie is covered with a layer of straw about 6 in. thick. A plank about 1 ft. broad and from 8 to 10 ft. long is then placed along the top or ridge of the pie, and the sides to the edges of the plank are covered with an inch or two of soil. The plank is then moved along and another length is covered with soil. In this way the top of the pie is kept free from soil, thus providing for ventilation. It may be necessary to add more soil to the sides later in the year, but the top is left untouched except, perhaps, in a time of severe frost, when a covering of potato haulm is put over the straw. Potato haulm should not be used for this purpose, however, unless the crop from which it was derived was quite free from disease.

* An illustration of a potato clamp appears on p. 59, and the question of storing potatoes in this way is dealt with on pp. 58-60.

THE FOOD VALUE OF THE POTATO CROP.

The increased importance assumed by the potato crop during the war has directed attention to the scarcity of information regarding the composition of British-grown potatoes. Hitherto this question has received but little notice, the figures commonly quoted being taken from Continental and American publications. These refer, of course, to potatoes grown on the Continent or in America, and it was necessary to assume that potatoes grown in this country were of approximately equivalent food value. It was recognised, however, that this assumption might prove to be incorrect, and with a view to investigating the matter a Sub-Committee of the Food (War) Committee of the Royal Society was recently appointed to make arrangements for further enquiry into the composition of potatoes grown in the United Kingdom. The report of the Sub-Committee will shortly be published, and it has been considered to be desirable to include a summary of the report in this supplement.

The only systematic investigation on any considerable scale hitherto made in this country appears to be the series of analyses made by Lawes and* Gilbert in connection with manurial trials carried out at Rothamsted during the 12 years 1876-1887 with the two varieties "Rock" and "Champion." On the average of the twelve years the averages for the individual plots showed a range from 25.6 to 28.1 per cent. of dry matter,* and from 0.236 to 0.392 per cent. of nitrogen, according to the manuring, the general average being 26.5 per cent. dry matter and 0.322 per cent. nitrogen. It may be noted that in these experiments, with the exception of the two "completely" manured plots, the yield of tubers was very low, so that probably only the produce of the two plots named can be regarded as normal. For these plots the average dry matter was 25.7 per cent. and nitrogen 0.330 per cent., figures which agree closely with the Continental averages as quoted by König, viz., 25.0 per cent. and 0.336 per cent. respectively.

The enquiry initiated by the Royal Society was carried out under the supervision of the Food Production Department of the Board, who made arrangements for the collection and

* The term "Dry Matter" refers to the total material other than water present in the potato tuber. This figure thus gives a rough measure of the food value of the crop. The nitrogenous ingredients of the "dry matter" have a special value which also needs to be taken into account.

analysis of representative samples of the more widely grown varieties included in the 1917 crop. Ten varieties were chosen for the purpose, and of these 227 samples were obtained. In addition, 20 samples of 17 miscellaneous varieties were analysed. The samples were obtained from about 70 growers in 18 English, 7 Welsh, 6 Scottish and 23 Irish counties. In all but a few cases the samples were drawn direct from the "pie" in the months of January to March, 1918, each sample consisting of 25 to 30 average-sized tubers.

The analyses were carried out at Aberystwyth, Armstrong College, Bangor, Cambridge, Leeds and Rothamsted. In view of the large number of samples to be dealt with the analysis was restricted to determinations of total dry matter and nitrogen, a uniform procedure in the methods of sampling and analysis, with slight variations in detail, being followed by the different analysts.

A summary of the results, including the averages and range of variation for each variety of which more than six samples were received, is given in the table on p. 25.

It will be noted that the general average of the 247 samples is 22.09 *per cent. dry matter* and 0.327 *per cent. nitrogen* (equal to 1.48 *per cent. nitrogen* in the dry matter).

The average dry matter content is appreciably below the Rothamsted and German averages quoted above, but is near to the average (21.7 *per cent.*) commonly given for American potatoes. The nitrogen average, on the other hand, agrees closely with those previously quoted.

No significant difference in composition is indicated between the late (maincrop) varieties and the early varieties, unless the higher average nitrogen-content of the latter should prove on further investigation to be characteristic.

The summary indicates that the range of variation throughout the individual samples was very considerable. Apart from a few exceptionally high or low figures the normal range of variation for the two types of varieties would appear to be as follows:—

		<i>Dry Matter.</i>		<i>Nitrogen.</i>
		<i>Per cent.</i>		<i>Per cent.</i>
Late varieties	..	18 to 27	..	0.24 to 0.40
Early varieties	..	19 „ 25	..	0.26 „ 0.38

The averages for individual varieties show considerable differences. If attention be confined to those varieties of which at least ten samples were obtained, it will be seen that "Arran Chief" was distinctly the richest in dry matter with an average of roughly 23½ *per cent.*, the "second early"

varieties "Great Scot" and "British Queen" following with an average of roughly $22\frac{1}{2}$ per cent., while the remaining varieties form a third group with about 21 per cent. of dry matter. "Evergood" comes out worst with an average of barely 21 per cent.

Although "President" and "King George V." cannot be placed with certainty owing to the small number of samples available, it is reasonably probable that the former is relatively rich and the latter relatively poor in dry matter.

TABLE I.

Variety.	No. of Samples.	Average.		Maximum.		Minimum.	
		Dry Matter	Nitro-gen.	Dry Matter	Nitro-gen.	Dry Matter	Nitro-gen.
		per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Maincrop Varieties—							
Arran Chief	52	23·31	·345	26·40	·475	18·69	·240
King Edward VII. ..	47	21·15	·323	25·24	·458	17·60	·243
Irish Up-to-Date ..	23	21·17	·286	23·40	·362	18·72	·204
Up-to-Date	22	21·31	·275	24·15	·280	18·16	·218
Evergood	20	20·83	·343	23·21	·395	18·19	·281
President	9	23·49	·346	26·01	·427	20·73	·282
Combined results from above Maincrop (6 varieties)	173	21·91	·322	26·40	·475	17·60	·204
Combined results from all Maincrop (17 varieties)	189	22·08	·324	29·08	·529	17·60	·204
Second Earlies—							
Great Scot	24	22·63	·351	24·83	·472	20·51	·261
British Queen	17	22·39	·306	24·63	·375	19·71	·227
King George V. ..	7	21·25	·310	22·70	·377	20·49	·269
Combined results from above Earlies (3 varieties)	48	22·34	·330	24·83	·472	19·71	·227
Combined results from all Earlies (9 varieties) ..	58	22·15	·334	24·83	·472	19·00	·227
Combined results from all varieties (including 17 "Miscellaneous Varieties")	247	22·09	·327	29·08	·529	17·60	·204

NOTE.—The composition given is that of the cleaned potatoes. The difference as compared with tubers as received from the growers is so small as to be not worth recording in detail. In the case of Arran Chief, e.g., the average difference is Dry Matter 0·04 per cent., Nitrogen 0·003 per cent.; King Edward, Dry Matter 0·04 per cent., Nitrogen 0·002 per cent.

In nitrogen-content "Arran Chief" and "Evergood" head the "late" varieties, of which at least ten samples were obtained, the former showing the more nitrogenous dry matter. "Up-

to-Date" is distinctly the lowest, both absolutely and relatively. In the "early" varieties "Great Scot" is markedly ahead of the other varieties and fully equal to the highest of the "late" varieties. The low position of "Up-to-Date" in both dry matter and nitrogen-content is worthy of note; also the concordance between the English and Irish averages for this variety.

The fact that certain varieties possess a higher dry-matter content than others is of considerable economic importance, especially in view of the fact that the varieties are also of good cooking quality. It is obviously desirable to ascertain whether the order of richness of the different varieties, as indicated by the 1917 crop, is definitely characteristic or largely seasonal.

From analogy with other crops it is probable that within each variety the composition of the tubers will be affected by such factors as the size of the tubers, nature of soil, manuring and general climatic influences. With so many variables involved it is clear that little definite guidance as to the specific influence of any one factor can be expected from a miscellaneous collection of samples grown under widely differing conditions over a very extended area. On one or two points, however, the data from the 1917 investigations throw some light.

This is particularly the case with regard to the regional variation between the eastern and western half of the country, representing, probably, in the main, the effects of difference of rainfall. This is illustrated by the following summary in which the longitude 2° W. has been arbitrarily selected as the line of division between east and west:—

TABLE II.

	East.			West.		
	Number of Samples.	Average.		Number of Samples.	Average.	
		Dry Matter.	Nitro-gen.		Dry Matter.	Nitro-gen.
		per cent.	per cent.		per cent.	per cent.
Arran Chief ..	34	23·83	0·343	18	22·32	0·350
King Edward VII.	29	21·19	0·318	18	20·95	0·329
Great Scot ..	12	23·09	0·344	12	22·17	0·359
British Queen ..	7	23·04	0·308	10	21·93	0·304
Average of above	—	22·72	0·331	—	21·79	0·337

It will be noted that for each variety the average dry matter is distinctly higher and (with one exception) the nitrogen-content lower for the east than for the west, the average difference being roughly 1 per cent. dry matter and '01 per cent. nitrogen.

As regards the variation from north to south, taking roughly the latitude of Nottingham as an arbitrary line of division, the averages for the same four varieties are as follows:—

TABLE III.

	East.			West.		
	Average.			Average.		
	Number of Samples.	Dry Matter.	Nitro-gen.	Number of Samples.	Dry Matter.	Nitro-gen.
North	31	per cent. 22·68	per cent. 0·348	19	per cent. 21·95	per cent. 0·350
South	51	22·75	0·321	39	21·72	0·331

Making due allowance for the east-west variations there would appear to be no marked difference in dry matter between north and south, but an appreciable difference in nitrogen-content in favour of the northern half.

The trend of these regional variations is indeed what one would expect since the outstanding difference in general conditions of growth as between east and west is one of rainfall, whilst between north and south it is more one of temperature.

The results further afford some evidence of correlation between the size and composition of the tuber, both dry matter content and nitrogen-content apparently tending to rise with increasing size of tuber. This is directly opposite to experience with swedes and mangolds and further confirmatory evidence must therefore be awaited before a definite opinion on the point can be formulated.

The data have been further examined for evidence of correlation between the composition of the tubers, the soil characteristics and the manuring of the crop, but the material is clearly inadequate and unsuited for the purpose, and no definite conclusions are possible.

The enquiry made last year is being continued and analyses are at present being made of potatoes of the 1918 crop.

POTATO DISEASES.

A. D. COTTON,

Mycologist to the Board of Agriculture.

The following article gives a brief account of the potato diseases occurring in Britain. In all the more important cases a fuller description will be found in the Board's leaflets. Although in the majority of cases the life-history of the parasitic organism is more or less understood, much further research, especially with regard to control methods, is required. In order to make the article complete it has been thought advisable to include all the recognised potato diseases of the country, even though our knowledge is in some cases admittedly most meagre.

Owing to the neglect of the subject no exact figures are available as to the damage inflicted by the various parasites dealt with in this article, but the total loss caused by disease and by decay in storage (*see* p. 48) is enormous. There is no question that much of this regrettable wastage might be saved were pathological research adequately organised and its results made available for practical use.

The diseases dealt with are as under :—

Potato Disease or Blight, p. 28.	Black Speck Scab, p. 43.
Wart Disease, p. 31.	Violet Root Rot, p. 44.
Corky or Powdery Scab, p. 34.	Pink Rot, p. 44.
Black-Leg or Black Stem-Rot, p. 36.	Verticillium Disease, p. 45.
Leaf-Curl, p. 38.	Sprain, p. 46.
Dry Rot, p. 39.	Internal Rust Spot, p. 47.
Potato Scab, p. 40.	Skin Spot, p. 47.
Sin'k Disease, p. 41.	Silver Scurf, p. 48.
Botrytis Disease, p. 43.	Rust, p. 48.

POTATO DISEASE OR "BLIGHT" (*Phytophthora infestans*).—To the farmer blight is a disease only too well known, and the spraying campaign of the last few years has made many others, who were previously unaware of its existence, alive to the importance of controlling its ravages. The potato blight fungus (*Phytophthora infestans*) reduces the possible yield of the crop by destroying the foliage and stalks of the plants, and also by causing a specific form of rot in the tubers. In a wet summer, if precautions are not taken to prevent it, half the crop may be lost, and even in an average season the disease claims a very considerable toll of the tubers.

Description.—The appearance of blight is too well known to need more than a brief description. The first signs are the presence on the leaflets of dark spots, which gradually increase



Under surface of a potato leaf attacked by "blight.



Upper surface of a potato leaf attacked by "blight."

in size and become brown or almost black (*see fig.*); if the weather be unfavourable, these spots extend until almost the whole of the foliage collapses and blackens. If the under surface of a spot is examined a delicate white mould may be seen (*see fig.*) (especially around the margin). This mould consists of the spore-bearing filaments of a fungus, the main part of which is to be found inside the attacked tissues of the leaf. The external mould is merely its reproductive portion, developed by the parasite at the expense of the nutrient material absorbed from the cells of the host which it destroys.

The aerial spores of the fungus are borne on these branched filaments and are exceedingly minute. They are produced in vast numbers, and are scattered from one plant to another and from field to field by wind or other agencies. As every spore brought into contact with a damp potato leaf is capable of starting a new centre of infection, it will be readily understood that under favourable conditions the disease spreads rapidly.

The disease is seldom conspicuous before the end of June or even the middle of July, although careful search may reveal its presence on a small scale somewhat earlier. The severity of the attack and the rapidity of its spread are entirely dependent on the nature of the season. In a dry season it may hardly be noticeable, except to a careful observer, but in damp weather it spreads readily. In a warm, damp July or August the disease often spreads with remarkable rapidity, and whole fields may be blackened completely in the course of a few days. In most seasons blight is prevalent to some extent in September and October, and it usually causes somewhat premature decay of the foliage.

Infection of the Tubers.—The spores, which are produced chiefly on the under sides of the leaves, fall to the ground, are washed down into the soil by rain and thus reach and subsequently infect the tubers of the new crop. From the spores germ-tubes are produced which penetrate the skin of the tuber, and from them mycelium (spawn) develops within the tubers and kills the cells.

A potato tuber infected with the blight fungus at first shows nothing but a slight darkening of the skin over the affected area. Soon, however, this area becomes somewhat sunken and of a leaden colour. When cut open the diseased tissue shows a rusty or foxy-red appearance which is at first confined to the skin region, but which gradually penetrates deeper and deeper until the whole tuber is destroyed. When

a tuber is destroyed by *Phytophthora* alone the decay is of the nature of a dry rot; but when (as is much more often the case) other minute organisms follow, wet rot often sets in.

During autumn and winter the greater number of blighted tubers are completely killed, but some survive and still contain the fungus mycelium in the affected portions of their tissues. Hibernation of the living mycelium may, therefore, be said to occur in some of the diseased tubers, and this is the only known method by which the fungus survives in nature from one season to another.

Source of New Infection each Season.—The reappearance of blight each season is mainly due to the fact that a certain number of tubers infected with the disease are planted as "seed."

If slightly diseased tubers are planted in spring, the mycelium continues its development and many rot completely in the ground without producing any plants. The remaining few grow and give rise to plants of varying degrees of vigour, and, unless they are infected independently later on, most of these remain quite healthy. On the other hand a very small proportion of these may produce above ground one or more diseased shoots bearing the fungus in its fruiting condition. Such primarily-diseased shoots bearing the aerial spores of the fungus and derived from affected tubers have been shown to be centres from which the new crop may become infected. Great care should, therefore, be taken to plant sound "seed." Infection of the crop may also occur from spores borne on diseased sprouts or shoots of diseased tubers which have been discarded during winter or spring from pits, clamps, or other stores, and have passed the winter anywhere in the open without having become completely killed. Care should, therefore, be taken to destroy or bury deeply all such useless tubers.

Measures of Control.—The breeding of varieties resistant to blight is one of the most important and pressing problems connected with the research on potato diseases. Some fairly resistant varieties are already in existence, but their susceptibility varies in different parts of the country, and it is as yet too soon to draw up a formal list.

Until such varieties are forthcoming there is no doubt that the most effective means of checking the ravages of blight is to spray the crop with a copper sulphate fungicide, such as Burgundy or Bordeaux mixture. The accumulated evidence of many years justifies the conclusion that the cost of spraying in an average season is amply repaid by the greater yield of

healthy tubers. It is, however, important to realise that spraying is to be regarded as a means of prevention rather than as a cure (Fig. 2). It is not an infallible preventive of blight, but should rather be regarded as a measure of insurance, as a means of enabling the plant to tide over a time during which it is specially liable to infection. Suggestions as to the making of spraying mixtures, the dates and method of application, and much other matter relative to potato blight will be found at p. 63; *see also* Leaflet No. 23.

WART DISEASE (*Synchytrium endobioticum*).—Although wart disease did not attract attention until within recent years, it has now gained world-wide notoriety. The loss it may occasion even in a single season is sufficiently serious, and second only to that of blight, but there is an added evil with the wart disease fungus, which is not found with *Phytophthora*, namely, that it contaminates the soil. This is due to the presence of long-lived spores which are particularly resistant to the action of fungicides. The disease exists in certain parts of the country only, hence the importance of using every means to prevent its further spread. When once the soil is contaminated with spores the production of sound crops of any but immune varieties is impossible, and the cultivation of many old favourites has to be abandoned.

Description of Affected Plants.—In the early stages it may be easily seen that the young warts arise at the eyes of the tubers. The date of their appearance differs with the variety of potato. They increase in size and subsequently become irregular excrescences which, moreover, often run together, forming large masses. In certain varieties (e.g., Arran Chief) all resemblance to a normal tuber may be lost, the entire potato being transformed into a coralloid mass (Figs 4 and 5). The warts are at first white but as they become old they begin to turn black and finally rot away into a putrid mass from which a dark-brown liquid exudes. A crop of Arran Chief, King Edward, or Up-to-Date badly attacked by wart disease is a sight not readily forgotten.

These abnormal growths or excrescences are not confined to the tubers. They are found on the leaves and buds of the stem near the ground-level or on the tips of the underground stems if these rise to the surface. Affected leaves are much distorted and become fleshy. Warts are not found on the roots or on the tubers apart from the eyes. The explanation of this is one of the many points with regard to wart disease which await elucidation.

The spores are formed in the tissues of the warts, and for fungus spores are unusually large. They occur in profusion just beneath the skin and can be seen with a pocket lens as brown specks if the warts are examined before they become too old.

Life History of the Fungus.—In its earliest stages the fungus exists in the cells of the potato as minute masses of living matter, without any of the mycelium usually associated in the popular mind with a fungus. The parasite lives in the cells just beneath the skin, and stimulates these to active subdivision, and thus to the production of warts. During the growing season the disease is said to be spread by means of summer spores,* from which numerous motile *zoospores* escape and infect tissues. Later on, this phase is succeeded by a winter or resting stage. The resting-spores* are brown in colour, possessing a hard, resistant wall, and on decay of the diseased tubers, they pass into the soil and may remain there, in that form or in some other stage not yet discovered, with unimpaired vitality for many years. On germination the resting-spores give rise to numerous motile *zoospores*, similar to those arising from the summer spores, and these infect fresh potato tubers and so spread the disease to succeeding crops.

The exact length of time that the resting-spores remain alive is not known. In a dry state they probably lose their vitality sooner than if left in the ground. In the soil the fungus is known to live for several years, and well-authenticated cases have occurred in which the disease has reappeared after an interval of ten years.

As will be evident from the above, the fungus is easily spread from one locality to another by means of spores. Not only is it distributed in such obvious ways as by throwing diseased produce on the manure heap, or feeding it unboiled to live stock, but it may be carried by carts or farm implements, and even by the feet of animals, especially birds, notably rooks, starlings, and pigeons. The smallest portions of soil may contain many spores, and even the dust adhering to the skin of tubers (immune or otherwise) if grown on infected land may not be free from them. The greatest care, therefore, should be exercised not to convey the disease from one locality to another by means of seed likely to be contaminated, or by soil.

* Both the summer spores and the resting spores are more correctly spoken of as sporangia or spore-cases, since they both finally become cases in which minute motile *zoospores* are found.



Sprayed.

Fig. 2 Sutton's Satisfaction Potatoes

Unsprayed.



FIG. 3.— Root of Great Scot with excellent crop of clean tubers, and Arran Chief with no tubers.
Both plants from same plot.



FIG. 4 Tuber of Arran Chief, showing Wart Disease.

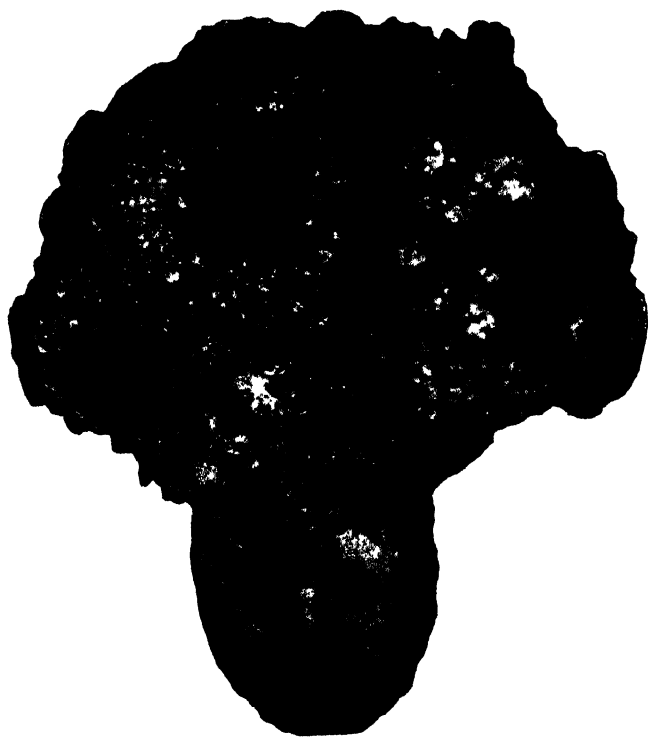


FIG. 5 —Tuber badly attacked by Wart Disease and commencing to decompose.

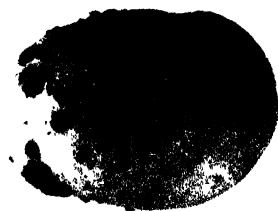


Fig. 6.—Early stages of Corky Scab, showing wart-like swellings from which the spore balls have not yet been discharged.

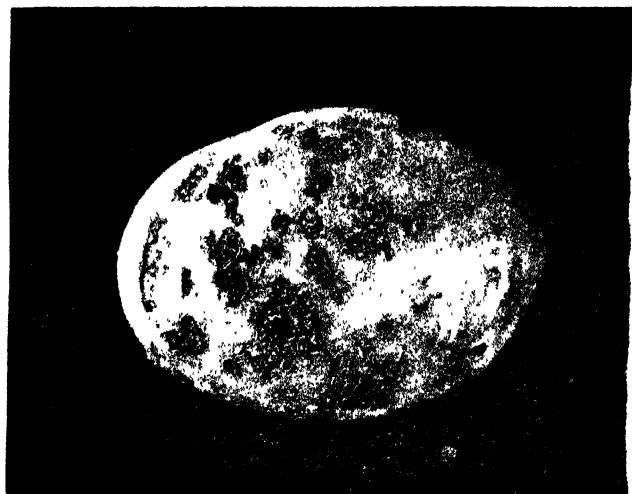


Fig. 7.—Later stage showing open Scabs after liberation of most of the spore balls. The ragged margins of the Scabs are characteristic.



Fig. 8.—Canker form of the disease, showing the destruction of the flesh of the tuber.



FIG. 6. Black leg of potatoes: attacked stem and diseased tubers.



FIG. 10.—"Potato Leaf Curl."

(Reproduced from a paper by Dr. A. S. Horne in "*Annals of Applied Biology*" Vol. 1., by kind permission of the Cambridge University Press.)



FIG. 11.—DRY ROT (*Fusarium caeruleum*).—Potato tuber suffering from Dry Rot showing the white spore-bearing pustules of the fungus and the shrivelled flesh of the tuber.

(The Board are indebted to the courtesy of the Royal Dublin Society for permission to reproduce this illustration.)



FIG. 12. -ORDINARY OR BROWN SCAB.—1 represents a young tuber freshly dug from the soil showing the scabs in their early stages. 3 and 4 show later stages, flat open scabs, as commonly seen on digging in autumn. 2 represents the appearance of a badly scabbed tuber when thoroughly dried.

(For the use of three of these illustrations the Board are indebted to the Department of Agriculture and Technical Instruction for Ireland.)



FIG. 13.—STALK DISEASE.—A stalk attacked in two places, at one of which fracture has occurred.

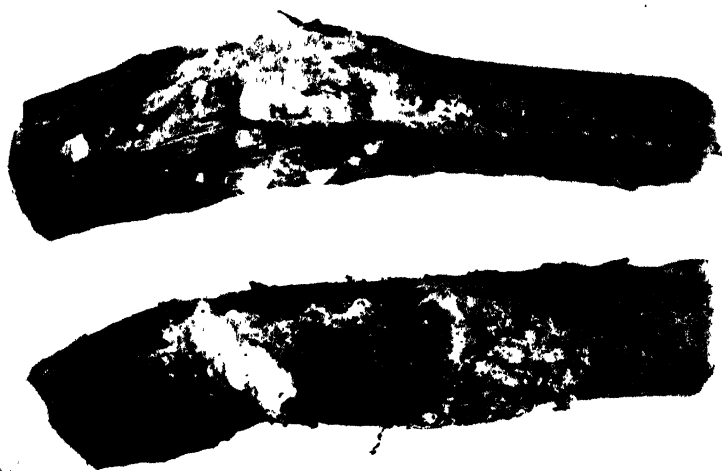


FIG. 14.—STALK DISEASE.—The white bodies on the surface of the stalks are immature scrota.

Distribution of the Disease.—Wart disease is most widely prevalent in the northern and midland counties of England and in Wales, and it has been found necessary to certify a number of districts as "Infected Areas," wherein only approved immune varieties may be planted. The largest of these areas are the counties of Carnarvon, Flint, Merioneth and Glamorgan, the whole of Lancashire south of the river Ribble, a large area in North Salop and several parishes in the industrial districts of Staffordshire, Derby, Leicester, Nottingham and Warwick. South of a line drawn from the Wash to the mouth of the Severn the intensity of the disease is very slight, and except in parts of Hants and Somerset and in the neighbourhood of London there are only scattered outbreaks.

Control Measures.—The only method at present known of raising clean crops on infected land is by restricting cultivation to immune varieties, i.e., those which resist the attacks of the fungus. A selection of the best of these varieties is given on p. 34.

Many experiments have been made with fungicides of all kinds. Lime and sulphur, either separately or mixed in various proportions, have been found useless. Soot, sulphate of copper, formalin, potassium permanganate, copper arsenate, ammonium sulpho-cyanide, calcium hypochlorite, copper nitrate and many other fungicides have also been tried. But in no case did they meet with any success when the soil was thoroughly infected.

Until quite recently wart disease was only known to attack the potato itself, but it has now been found to be capable of infecting also, though apparently only to a very small extent, the Woody Nightshade (*Solanum dulcamara*) and the Black Nightshade (*S. nigrum*). This fact should be borne in mind when attempts are being made to clear the ground of the wart disease fungus, and any specimens of these two weeds should be uprooted and burned. There is no record at present of any other solanaceous plants being attacked by the fungus.

Immune Varieties.—The trials carried out at Ormskirk* by the Board of Agriculture and Fisheries have demonstrated beyond all doubt the absolute immunity, for the time being at any rate, of certain varieties (Fig. 3). Disappointment in the past as to resistant varieties has been due either (a) to wrongly-named seed, or (b) to the presence of "rogues," or (c) to the use of varieties which, though formerly supposed to be immune, had not been properly tested on badly and uniformly infected

* See p. 68.

soil. As far as is known the immunity of no variety which has been thoroughly tested and classed as immune has as yet broken down.

The following is a selection of some of the best immune varieties recommended by the Board of Agriculture and Fisheries for planting in infected land on most classes of soil. Fuller lists are given in another article at pp. 90 and 95.

EARLY VARIETIES. *Edzell Blue.*

The stocks of suitable immune First Early varieties are, with the exception of the coloured round "*Edzell Blue*," extremely rare, but it is hoped that in 1920 stocks of other varieties will be available. The attention of growers is called to the advantages to be gained by sprouting the Second Early variety "*King George*" which can then be lifted almost as soon as "*Epicure*."

SECOND EARLY VARIETIES. *King George, Great Scot, The Ally.*

LATE VARIETIES. *Tinwald Perfection, Kerr's Pink, Majestic, Abundance* types; *Lochar, Golden Wonder and Langworthy.*

CORKY OR POWDERY SCAB (*Spongospora subterranea*)—The disease termed corky or powdery scab, though not so readily recognised, perhaps, as certain other forms of scab found on potato tubers, is very widely distributed, and is liable, under certain conditions, to bring about serious injury. In its mild form corky scab, which is due to the minute fungus *Spongospora subterranea*, usually appears as small, roundish or irregular scabs on the skin of the tuber. These are comparatively harmless, but in other cases the damage occasioned is more severe, a considerable destruction of the flesh being caused.

In the British Isles, corky scab is most prevalent in the wetter parts of the country. It is widely distributed in Scotland, where it is sometimes destructive, and the same applies to Wales and certain counties in the northern part of England. In Ireland also it is frequent, but in its severe form it occurs as a rule only in the ill-drained, boggy districts of the western counties. In the remaining parts of the British Isles corky scab seldom causes trouble, and it would appear that in such localities the soil and climate are not favourable to the extensive development of the parasite.

Corky scab in its early stages is very similar in appearance to common scab. The parasite causes small, conical warts

on the surface of the young tubers. These are white when freshly dug, but soon turn dark in colour (*see* Fig. 6). With further growth and continued irritation by the parasite the swellings enlarge, and rupturing the covering of the skin of the tuber reveal the presence of an olive-brown powder, which consists of the spores, or rather spore-balls (so called since the spores are tightly bound together in spherical clusters), which are the reproductive bodies of the parasite. The presence of this brown powder affords a character for distinguishing corky scab from common scab. When the spore-balls have disappeared from the surface of the tuber a small circular open scab is left, often indistinguishable from a spot of ordinary brown scab (Fig. 7). Many of the spore-balls are liberated before the tubers are lifted and in this way the soil becomes contaminated.

When corky scab assumes its severe form actual destruction of the flesh of the tuber takes place, the ultimate appearance presented being of the nature of a canker. Such injury is shown in Fig. 8, where the flesh is seen to have been destroyed, a large mass of spore-balls, which was at first covered by the skin of the tuber, having now fallen away. Between this canker form and the small scabs described above, all transitions occur.

The production of the canker form of corky scab is generally due to the presence of a wet, poorly-drained soil. The disease is prevalent in dry seasons, and there can be no doubt that abundant moisture in the soil is one of the most favourable factors for its development. The presence of an excess of lime also tends to increase the canker form.

The spore-balls remain dormant in the soil for a long time, but under suitable conditions of warmth and moisture they germinate, each component spore giving rise to very minute motile spores, which bring about the infection of the new crop. The exact length of time the spore-balls retain their vitality is not known, but it has been proved that they retain their power of infecting a new crop for at least three years.

Control Measures.—1. No good soil fungicide is known, hence potatoes should not be grown on badly-infected land. If this is inevitable, a dressing of flowers of sulphur at the rate of $6\frac{1}{2}$ cwt. per acre ($2\frac{1}{2}$ oz. per sq. yard) will tend to reduce the disease and probably also increase the yield. Lime should

not be used, but improvement in the drainage of the land would be beneficial.

2. Contaminated bags and other articles must not be used for clean seed, and care should be taken not to spread the disease by the use of contaminated manure or carts and implements. Badly-infected tubers or parings should be burned, or after having been boiled fed to pigs.

3. Slightly-infected seed, and seed which, though sound, has been contaminated by contact with diseased tubers or infected soil, may be disinfected by steeping for three hours in a weak solution of commercial formalin ($\frac{1}{2}$ -pint of formalin to 15 gallons of water).

4. As no other field crop is affected by corky scab, a long rotation will help to starve out the parasite of the soil.

"BLACKLEG" OR BLACK STEM-ROT (*Bacillus atrosepticus*).—**Description of Affected Plants.**—Blackleg is one of the earliest potato diseases to show itself. Affected plants may be seen as early as the middle of June, but they continue to make their appearance till considerably later. Diseased plants are somewhat stunted and are conspicuous even at a distance by their pale green or yellow foliage. The disease is caused by bacteria.

The most characteristic feature is to be found at the base of the stem. If affected stalks are pulled up, they will be noticed to come away easily and to be rotten and inky-black at their bases (see Fig. 9). In some plants all the stalks will be affected in this way, in others only one or two. The outer or cortical tissues will be soft and decayed, or perhaps entirely rotted away, and if cut open the pith will be found to be blackened or destroyed. The old "set" or "seed" potato will be completely rotten.

Another indication of blackleg is seen when affected stems are cut transversely. The section will show near its outer part three brown spots which are the woody portions of the principal vascular bundles. The brown colour is due to the action of the bacteria, and in bad cases it extends to the extreme apex of the shoot and sometimes manifests itself externally in the form of black streaks on the stem. If such vascular bundles are examined with the microscope, the tissues, at any rate in the most recently-affected portions, will be found to be teeming with bacteria.

Later Stages and Infection of Tubers.—As the season advances the leaves of affected plants turn brown and the stalks usually

die off. If the disease develops early this will take place before any new tubers are produced, but where the disease may have progressed more slowly or commenced later new tubers will have been formed, and a certain number of these will be affected, the bacteria having passed along the rhizomes (or underground stems) and entered in at the heel-end.

Diseased tubers may be recognised by being soft and discoloured, especially at the heel-end, and by the flesh being brown, and ultimately becoming wet and rotten. In bad attacks practically all the tubers decay in the ground, but in many cases the disease does not advance so rapidly, and the tubers remain sound for a time but decay badly in storage. Those tubers which are only slightly affected survive the winter and, if planted, give rise to diseased plants.

Decay in the store is also increased by infection of healthy tubers through contact with those which are diseased. The soft, wet mass formed in the rotting diseased tubers contains millions of the parasitic bacteria, and it has been proved by experiment that water containing these bacteria is capable of infecting and causing the decay of sound tubers. The heavy losses which occasionally occur in the pit are perhaps largely attributable to this form of infection, especially if the pit is wet or badly ventilated.

It has been proved beyond all question that blackleg is propagated by the use of diseased "seed." The seed may sometimes be so slightly infected as to appear externally quite sound, yet if planted it may produce diseased plants. The greatest care, therefore, should be exercised that none of the progeny of diseased plants be saved for planting purposes.

Control Measures.—1 As far as is practicable all diseased plants should be dug up and destroyed as soon as noticed, and the young tubers removed from the soil. Tubers which are sound may be used for immediate consumption. The remainder should be destroyed.

2. It is of the utmost importance to use only sound seed. Tubers which are the produce of affected plants, however sound they may appear to be, should never be saved for seed purposes. If possible, seed should be obtained only from areas where blackleg is not prevalent.

3. Care should be exercised in constructing the pits. All tubers showing any trace of disease should be excluded, and the pits made as dry and well ventilated as possible.

POTATO LEAF-CURL. Description of Affected Plants.—The most marked symptom of a plant affected with leaf-curl is the

curling inwards of the leaflets which gives the shoots an erect, rigid appearance (*see* Fig. 10). The leaflets curl over towards the midrib, and at the same time the leaves assume a more or less erect attitude instead of lying somewhat horizontally as in a normal plant. Very frequently it is only the upper leaves which are curled, but at times the entire plant exhibits this phenomenon, and in bad cases the haulm is shorter than usual and the plant remains dwarfed. Together with the curling of the foliage there is usually a change in colour in the affected leaves. The colour varies with the variety of potato. Most of the leaves become pink or tinged with mauve, but in some varieties a yellow hue is assumed.

Affected plants are checked in their growth, and as a result the yield is very distinctly reduced. The amount of decrease depends on the intensity of the disease. In slight attacks the tubers, though numerous, remain small. In more serious cases only a few tubers develop, and in extreme attacks no crop at all is produced. In almost all cases, the parent set fails to decay, and the new tubers which are formed tend to cluster round the base of the stems.

Cause of the Disease.—The actual cause of leaf-curl is still obscure, but it is not now regarded as a disease caused by a parasitic organism. The symptoms manifested, such as stunting of the growth, curling of the leaves, and poorness of crop, clearly indicate that the functions of the plant are not proceeding normally, but the exact cause of this disturbance is still a matter of speculation. Whatever the cause, the effect is sufficiently great to influence the seed tubers, since tubers from affected plants give rise to diseased plants the following year. The disease, therefore, may be said to be inheritable, and hence great care should be exercised in the selection of seed.

Of the many causes which have been suggested, the use of over-ripe seed is perhaps the most probable. Such seed might be due to the result of growth in warm, dry soil, or to a sudden check, due to a dry spell in July or August. This view finds some support in the fact that seed saved from the southern and drier parts of England is more subject to curl than Scotch or Irish seed. Further work on the subject is, however, urgently needed.

Control Measures.—1. As the disease is inheritable tubers from affected plants should not be used for seed, nor would it be wise to save seed from healthy plants if any considerable portion of the entire field or plot were affected.

2. Good seed from a northern source should be used. This is specially important in districts where leaf-curl has

been troublesome, as, although local conditions are perhaps not the direct cause of the disease, climate and soil materially affect its intensity. Only the best seed, therefore, should be procured.

DRY ROT OF POTATOES (*Fusarium caeruleum*).—All growers of potatoes are probably more or less familiar with this fungus disease, which attacks the tubers during storage and causes their decay. In the initial stages of attack dry rot appears as a superficial patch that is darker in hue than the surrounding skin and somewhat sunken. As the diseased area increases it becomes corrugated or wrinkled in irregularly concentric rings and shrinks considerably (see Fig. 11). Pustules of the fungus, white and downy in appearance, then begin to burst out through the skin, whilst the internal tissue of the potato becomes, as the disease proceeds, brown and shrunken.

In bad cases the rot continues until the potato becomes hard, dry, and quite light in weight. If the attack commences very late, or makes but slow progress, the tubers survive till planting time and commence to sprout. Such tubers, if planted, generally die and produce no plants at all, but they may grow and develop small though healthy plants. Failure of planted seed tubers (especially in early varieties) to produce plants is frequently due to the dry rot disease.

Causes leading to Attack.—Dry rot may start at any point on the tuber. It most frequently starts from a wound, but wounds are not essential for infection, for it has been proved that potatoes with unbroken skins can also be attacked. In such cases the disease usually starts at an eye or lenticel (breathing pore). The maturity of the tuber has a considerable influence on its susceptibility to infection; the more mature the tuber is, and the nearer it is to the time of sprouting, the more easily it becomes infected. As a consequence the disease is usually most prevalent in the early months of the year: it seldom causes serious trouble before December.

Susceptibility of Varieties.—Varieties differ considerably in their susceptibility to dry rot. Early sorts suffer more than late varieties, and certain varieties, such as May Queen, Ninety-fold, Reading Russett, and Duke of York are particularly susceptible. Others, such as Epicure, are fairly resistant, though probably none are absolutely immune.

Control Measures.—1. As soon as dry rot appears in the store the tubers should be gone over and all affected ones removed, and the process repeated as frequently as practicable.

2. Badly-diseased potatoes should be burned. Cutting out the diseased portions and treating with sulphur or lime does not check the disease.

3. Potatoes attacked by dry rot should never be used for seed.

4. When digging potatoes great care should be exercised to avoid mechanical injury to the tubers, especially if they are to be kept for seed purposes.

5. Where dry rot is anticipated precautions should be taken as to storage. All tubers which are affected with any kind of disease should be removed before storing. The storage place should be well ventilated and cool. Where the disease is very bad and reappears each year it is advisable that the storage boxes and the walls of the cellar or loft should be disinfected or washed down with a 2 per cent. solution of copper sulphate.

COMMON SCAB. (*Actinomyces* sp.).—The common potato scab or brown scab is one of the most widespread diseases affecting the potato, and is exceedingly abundant in small gardens and allotments, especially where potatoes have repeatedly been grown, and where ashes, lime, and other alkaline substances have freely been used. Scab is caused by a minute soil-organism named *Actinomyces*, which attacks the surfaces of the tubers and causes the production of dark scattered scabs, or large eroded patches which appear to have been worn away or gnawed (*see* Fig. 12). The scabs increase in size with the growth of the tubers, and in bad cases cover almost the entire surface. They consist of a mass of corky tissue formed by the potato tuber as a result of the irritating action of the parasite.

Though very widely distributed in garden soils, the scab organism only becomes parasitic and attacks the potato when the soil conditions are such as render it specially active. The recent application of lime, lime-rubble, ashes, and even farmyard manure tend to render the soil alkaline, or at least neutral, a condition which favours the virulence of the parasite. It was formerly thought that these substances were the cause of the disease, but it is now clear that they are merely assisting influences and not the cause itself.

Control Measures.—It is clear from the above that the most important preventive measure is suitable treatment of the soil. The organism thrives in alkaline soils, and in those rich in humus. Hence the application of lime, ashes, and soot, and also farmyard manure, should be temporarily suspended in soils where scabbing is prevalent. Alkalinity of the soil may

be counteracted by the use of superphosphate of lime and sulphate of ammonia. In small gardens and allotments a dressing of flowers of sulphur at the rate of 1 oz. per square yard should prove beneficial. Its effects, however, may not be fully noticeable the first season.

Crop rotation is always a commendable practice and should be adopted as far as possible even in small gardens. As a preventive for scab, although it cannot be regarded as altogether effective, it doubtless assists in keeping in check a special potato-attacking strain of the scab organism.

STALK DISEASE (*Sclerotinia sclerotiorum*).—The stalk disease of potatoes is most destructive in the northern and damper parts of the country. In the west of Ireland the loss occasioned by it is so great that, with the exception of the ordinary potato blight (*Phytophthora infestans*), it has been stated to be the most serious disease with which growers have to contend. *Sclerotinia* attacks the stem, either near the ground or at some distance above it. Subsequently it penetrates the inner tissues and destroys them so that the stem falls over at the affected spot and dies. Though the tubers are not attacked the yield is reduced owing to the death of the shoot, and in districts where *Sclerotinia* is widespread the crop may suffer very severely.

Description.—The disease first shows itself in the form of white patches of fungus threads or *mycelium*, on the outside of the stem (Fig. 13).^{*} In contrast to most stem diseases there is little yellowing of the foliage, with the result that infected plants are easily overlooked. If dull, damp weather prevails the mycelium develops rapidly and begins to form oval or spherical cushions, white in colour, and from which minute drops of water exude (Fig. 14). These cushions represent the youngest stages of the resting bodies known as *sclerotia*. The sclerotia later becomes firm and finally hard and black, though internally they remain white. When ripe they fall off and remain dormant in the soil until the following spring.

In addition to forming external mycelium and sclerotia the fungus gradually penetrates the inner tissues of the stem. The cells are invaded, and the pith-cavity is filled up with fluffy white mycelium in which sclerotia, similar to those produced externally, develop (Fig. 15). The latter remain inside the stems, but ultimately reach the soil if the stems are allowed to decay on the land. The result of this internal

^{*} For the illustrations of this disease the Board are indebted to the Department of Agriculture and Technical Instruction for Ireland.

development of mycelium is the blocking up of the water-conducting channels. At the point of attack the tissues are killed and the stem bends over, and sooner or later dies.

The sclerotia remain dormant in the soil until early summer, when they germinate and give rise to small disc- or cup-shaped bodies termed apothecia, which produce the spores (Fig. 16). The cups are borne on slender stalks, and appear just above the surface of the soil. They are pale, brownish-yellow in colour, and when ripe discharge their spores into the air, usually in large numbers at a time. If the apothecia are carefully watched, smoke-like puffs of spores may be seen arising from them. The intermittent discharge of spores from a single cup may continue for two or three weeks.

Infection of potato plants in summer is brought about by the spores derived from the apothecia. On germination the spores are capable of infecting the older and fading leaves, and from the leaf the fungus passes into the stem. In some cases direct infection of healthy tissues apparently also takes place, especially in parts of the plant such as leaf-axils where moisture is preserved.

The fungus *Sclerotinia* attacks several other plants in addition to the potato. In each case it is perpetuated in winter by the hard, black sclerotia in the soil, and propagated in early summer by means of the spores liberated from the cup-shaped apothecia.

Control Measures.—The most important measure to adopt is systematically to collect and burn all diseased portions of the plant in order to prevent the sclerotia from reaching the soil. If this is carried out thoroughly, the number of spore-bearing cups produced in spring will be largely reduced.

Applications of lime and spraying with fungicides have not yielded satisfactory results.

Unless the soil has been sterilised, plants liable to be attacked by *Sclerotinia* should not be grown for at least three years in infected soil. The fresh site selected should be well removed from the old one.

In the case of potatoes, in the badly-infected districts late planting has proved successful, the explanation being that fewer old leaves (which provide the fungus with an easy means of entry) are available at the time of the main spore-discharge.

BOTRYTIS DISEASE (*Botrytis cinerea*).—The fungus *Botrytis cinerea* which is very common on dead vegetable matter, becomes, under certain conditions, parasitic and attacks the living tissues. In the wetter parts of the country, and in damp seasons especially, it frequently causes damage to potato plants.



FIG. 15.—STALK DISEASE. Three potato stalks split open showing numerous sclerotia in their hollow interiors.



FIG. 16.—STALK DISEASE. A single sclerotium which, after lying dormant during winter, has produced a spore-bearing cup or apothecium (nat. size)

FIG. 17.—Violet Root Rot.



FIG. 18. Portions of dead potato stems which have been attacked by *Botrytis cinerea*. The sclerotia of the fungus show as small black flattened bodies closely attached to the stems (nat. size).

The spores of the fungus germinate as a rule upon old dead leaves and from these spread to the sound tissues, but during spells of warm, damp weather direct infection of young healthy foliage occurs. In this case the disease shows itself as brown, dead areas usually at the tips of the leaflets. The mycelium (or fine filament of the fungus) rapidly destroys the tissues, and, growing through the leaf-stalk, enters the stem, whence it proceeds in a downward direction, killing the outer tissues and involving also the loss of other leaves. In many cases the attack is slight and only a small portion of the stem and a few leaves are affected, but with continued wet weather it is more severe and the whole of the shoot dies and turns brown. The tubers themselves are not invaded by the fungus but the yield may be lowered if the attack on the foliage is severe. A greyish mould develops on the surface of diseased leaves and especially on those which fall off or are near the ground. The mould represents the fruiting stage of the *Botrytis* fungus and consists of myriads of spores borne in minute heads. These spores are dispersed by wind and rain, and, germinating at once, rapidly spread the disease.

After the spore-phase the fungus forms sclerotia which, later in the season, appear as small, flat, black structures on the dead, blanched stems (see Fig. 18). The sclerotia, which are resting bodies, germinate in spring and produce crops of spores similar to those found on the leaves and stems, and in this way the life-cycle of the fungus is completed.

Control Measures.—In districts where *Botrytis* is troublesome special care should be taken to avoid overcrowding. When planting in spring sufficient space should be allowed both between the sets and between the rows.

Varieties which are resistant to ordinary blight have been found resistant also to *Botrytis*, hence such varieties should always be selected.

In order to lessen the chances of re-infection in spring, old diseased stems bearing sclerotia should be collected and burned before the crop is lifted.

BLACK SPECK SCAB OR COLLAR FUNGUS (*Corticium Solani*).—Potato plants frequently show the presence of small masses of fungus mycelium, at first pale, but afterwards dark brown or black in colour, on the surface of the tubers. The bodies are formed on a network of almost invisible strands of similar brown fungus filaments and they represent sclerotia or resting masses of tissue found so frequently amongst fungi. This fungus has long been familiar in the literature

of plant diseases as *Rhizoctonia Solani* and the disease has been termed black speck scab, although the term scab is not particularly appropriate. It is now known, however, that this brown mycelium is merely the subterranean portion of another fungus named *Corticium Solani*, which occurs as a thin white incrustation at the base of potato stalks. The latter is the perfect or fructifying stage of the fungus, and is known as the potato collar-fungus.

Neither stage of *C. Solani* appears to cause much damage in this country. The sclerotial stage is exceedingly common, but the sclerotia, though causing disfiguration, are quite superficial and can be easily removed with the finger nail. The mycelium, however, occasionally causes damage by attacking and injuring the young sprouts before they come above ground in the spring. The disease is more prevalent in light soils and in dry climates, and in America it appears to cause more trouble than in Britain. The collar-fungus stage is likewise superficial and causes no damage, but by producing spores serves to propagate the disease.

VIOLET ROOT ROT (*Rhizoctonia violacea*).—This is another soil fungus related to the last, but a much more dangerous parasite. It attacks especially the fleshy roots and crowns of many plants, and occasionally the tubers of the potato. The spore-bearing stage of the fungus has not been discovered and it is possible that under the name *R. violacea* several distinct varieties or strains may exist. On the potato tuber the fungus forms a loose, violet-coloured mycelium which spreads completely over the surface, and forms in certain areas innumerable sucker-like bodies which penetrate the skin and bring about the total or partial destruction of the flesh (Fig. 17).

Control Measures. The fungus is, fortunately, not common in Britain, but when it occurs it is difficult to eradicate. Lime is said to check the disease, but further investigations as to a suitable fungicide are needed. Diseased tubers should be collected and burned, and soil likely to be contaminated should not be used for potatoes, root crops, lucerne, or clover.

PINK ROT (*Phytophthora erythroseptica*).—The disease known as pink rot of potato tubers is common in parts of Ireland, especially in the west, and judging by external symptoms almost certainly occurs in this country. Recently, indeed, it has been found in Scotland. The fungus causes a wet rot of the tubers, and the disease owes its popular name to the fact that the cut surfaces of infected tubers quickly turn pink when exposed to the air.

Pink rot commences when the potatoes are still in the ground, and has been found in some varieties as early as July. In most cases the attack begins at the "heel" end of the tuber, and proceeds rather quickly towards the "rose" end. Diseased tubers remain firm, but if pressed exude a quantity of juice, and finally become completely rotten. They do not, however, develop cavities, as in the case of blackleg. A characteristic series of colour-changes takes place when affected tubers are cut open and exposed to the air. The pink colour begins to show after a few minutes, and within half-an-hour the whole of the diseased portion becomes a deep salmon-pink. With an exposure of several hours the cut surface gradually darkens and becomes purplish-brown or nearly black.

Plants infected with the pink rot fungus show also indications of unhealthiness in the foliage, due to the presence of mycelium in the stem and roots. This occurs generally rather late in the season. The leaves become pale green or yellow, and the symptoms are those of the wilt type. Resting spores of the fungus are found in the underground stems and also in old diseased tubers, and in this way the contamination of the soil is brought about.

The losses caused by pink rot are considerable, in some cases heavier than those due to blight. They are greatest in crops grown continuously on the same land (infection taking place from the soil) and can be avoided by proper rotation.

VERTICILLIUM DISEASE (*Verticillium albo-atrum*)—It is only since 1916, when the researches of Dr. G. H. Pethybridge clearly defined the *Verticillium* disease, that this malady of potatoes has been generally recognised. The disease is distributed in the seed, and in 1918 it was observed to be locally prevalent in several parts of England, being responsible for the premature death of the haulms and for light crops. The fungus invades the wood vessels of the stem and causes a more or less premature death of the plant owing to the water-conducting vessels being choked with mycelium. Infected plants are often stunted and resemble to some extent those affected with Leaf-Curl, but the symptoms vary considerably under different conditions. In some cases affected plants die off gradually, but more often in light soils and in dry weather they suddenly flag and the symptoms are those of a wilt disease. The disease can only be identified with certainty by verifying the presence of the fungus in the stem.

The life cycle of the fungus is as follows:—In the plant, while still alive, the mycelium is only found in the vascular bundles, and it is confined in them to the wood vessels. With the sprouting of the tuber it passes along the vessels into the new shoots, though sometimes not until the latter have made considerable growth. In later stages the mycelium may advance up the shoots into the wood vessels of the petioles and leaves, though in cases of bad infection the water-conducting tissues become so blocked that the plants wither and die off early in the season. From the base of the haulms the fungus also passes into the underground stems and from these into the new tubers. The mycelium penetrates well towards the rose-end of the tubers even in the autumn, and during winter it advances further. Affected tubers appear outwardly quite normal, but within they usually show a discoloration of the vascular tissues, especially at the heel end, but the absence of a dark ring in the tuber is not necessarily a proof of clean seed.

Control Measures.—The disease is mainly perpetuated by means of infected seed, but it is possible and, indeed, probable, that it may also be contracted through the roots from contaminated soil. The most important preventive measure for the present consists in treating the produce of all infected plants as ware and saving seed from healthy plants only, and from uninfected areas. All diseased haulms and roots should be collected and burned.

It has been shown that the mycelium in the tissue of a potato tuber can be killed by heat without at the same time killing the tuber. Further experiments are required to establish the limits of time and temperature necessary to disinfect the tuber with the least amount of adverse influence on its own tissues before this method can be recommended in practice.

SPRAIN.—The term sprain is applied to brown or dark coloured blotches or streaks in the flesh of potato tubers in which no fungus or other parasitic organism has been detected. It is probable that several distinct diseases are included under this name, but they have not been clearly described or classified, and much further research is required. Sprain is usually said to occur on light, stony soils and to be more prevalent in dry seasons. The disease next mentioned, now known to be due to a bacterial parasite, was formerly regarded as a form of sprain. In some cases sprained tubers if planted produce a

sound crop, but in the absence of information as to the different forms of sprain and their etiology, no definite control measures can be recommended.

INTERNAL RUST SPOT.—This name has been given to a bacterial disease of potatoes in which the tubers are marked with brownish-red patches. The spots vary in size from that of a pin's head to an inch or more in diameter, and are distributed irregularly through the flesh. The disease, which was previously regarded as a form of sprain, has quite recently been investigated by Dr. S. G. Paine, who, in a preliminary paper, states that he has succeeded in isolating a parasitic bacterium as the causal organism. The diseased patches can sometimes be traced to lenticels on the surface, indicating that the exciting cause has found entry into the tuber through these structures.

Internal rust spot has recently been reported from several parts of England and is probably not uncommon. It occurs also in Germany, and has been described by several German workers, who, however, regarded it as due to physiological causes, and did not discover the causal organism.

Control Measures.—Since it has now been proved that the disease is caused by a parasite it is clear that one of the chief measures of control is to avoid contaminating the soil by the use of affected seed.

SKIN SPOT.—Skin spot is an affection which develops on tubers, specially during winter and spring, and is apparently very frequent in certain classes of soil and in certain seasons. It is caused by a fungus which produces small, dark spots or pimples, penetrating the flesh to a depth of about $\frac{1}{8}$ -inch. The pimples ultimately become ruptured and leave a small, dark, open scab.

Skin spot has hitherto been regarded as being due to the fungus *Spicaria Solani*, but recent research carried out at Kew shows that this is not correct, the fungus being apparently a new and undescribed species. As far as is known at present skin spot does not cause serious injury, since the potato tubers succeed, by means of the formation of successive layers of wound-cork, in preventing the fungus from entering far into the flesh. It is inadvisable to plant tubers badly affected with skin spot, particularly if the eyes are liable to be weakened.

SILVER SCURF (*Spondylocladium atrovirens*).—This fungus is exceedingly common on potato tubers, and on certain light soils it can, if carefully searched for, be found on

practically every tuber. It forms slight blemishes on the skin, often extending over a considerable area. These blemishes occur as discoloured or silvery patches and are more conspicuous in spring, especially on tubers which have become slightly greened. They are often somewhat depressed and are dotted over with black specks. The latter are minute sclerotia, and these, under suitable conditions, give rise to spores. Occasionally the affected areas become somewhat dry and flake off, but otherwise the fungus appears to cause no appreciable damage.

RUST.—Rust is the popular name for a disease of potato plants characterised by the presence of brown or rusty markings on the foliage. It is not a "rust" in the botanical sense since it is not caused by one of the rust fungi, and, indeed, no fungus or bacterial parasite of any kind has been found. The trouble is believed to be largely due to the use of poor seed, but the matter requires research and carefully conducted experiments under various climatic conditions. Though most frequent in allotments the disease also occurs in fields, especially in the West of England. It usually develops when dry weather prevails early in the season, or when a hot, dry spell follows rain.

THE CAUSES OF DECAY IN POTATO CLAMPS, WITH SPECIAL REFERENCE TO THE SEASON 1918.

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INTRODUCTION.—The rotting and heating of potatoes in the clamp* is a trouble familiar enough to all farmers. It is, however, a form of loss that is often regarded as inevitable and one which has unfortunately received little attention at the hands of scientific workers in this country. This is greatly to be regretted, because the seriousness of the loss is often equal

* The potato "clamp" is also known as a "pit," "pie," "grave" or "hog," according to the custom of the locality.

to or even greater than that in the growing crop, and also because with clearer knowledge and more attention to methods of clamping a considerable portion of this wastage might be prevented.

The causes of decay and heating are generally regarded as the result of adverse weather conditions, the presence of blighted tubers in the clamp, or due to faulty methods of clamping. This is, in the main, correct, but an inquiry into the nature of the losses experienced last winter emphasised the importance of a thorough acquaintance with the various forms of decay and the different factors chiefly concerned in bringing them about.

In the winter of 1918-19 there was exceptional amount of rotting, which, moreover, began to show itself earlier than usual. In the beginning of January "falling in" of potato clamps on a large scale in the Fen districts of Lincolnshire and Cambridgeshire was reported to the Board. Accounts of somewhat similar damage, but on a smaller scale, were received from various other parts of the country.

Preliminary inspection had shown that, in addition to the ordinary blight, a wet rot was present, and that serious heating was taking place. In some cases the heat evolved was so great that the tubers were found to be cooked, and a thermometer inserted in the hottest part of the clamps registered in extreme cases a temperature of 150° and 160° F. A special inquiry was at once instituted to ascertain the nature of the decay and the causes of heating. This inquiry is still in progress, but the results so far obtained have been fully reported to the Board.

The object of the present article is to point out the chief forms of decay, the causes of heating, and to suggest, as far as is yet possible, preventive measures. A more detailed and critical paper, together with full references to existing literature on the subject, will be published elsewhere.

I. THE FORMS OF DECAY.—Decay in storage may be due to several distinct causes, of which the following may be regarded as the most frequent and the most important in this country:—

- (1) The presence of tubers affected with blight (*Phytophthora infestans*, which forms either (a) a dry rot when unmixed with bacteria, or (b) a wet rot when certain conditions of warmth and moisture favour decay through the secondary action of bacteria;

- (2) A wet rot due to bacterial decay of tubers which had been flooded or waterlogged previous to clamping;
- (3) A similar decay due to the inclusion of tubers which had been injured by frost;
- (4) A wet rot owing to the presence of tubers affected with the blackleg bacillus (*B. atrosepeticus*);
- (5) A wet rot due to bacterial decay brought about by the heating of the clamp;
- (6) A dry rot due to the development of the parasitic fungus (*Fusarium caeruleum*); and
- (7) A wet rot as a result of damage by frost which had penetrated the clamp.

The nature of the decay which these various rots produce is not thoroughly understood, but a brief outline of what is known is given below.

(1) **Blight.**—In an attack of pure blight (*i.e.*, when the fungus *Phytophthora* is present alone and not mixed with other organisms) the rot produced is a dry one. The different forms of decay which subsequently take place in a blighted tuber have never been carefully studied, but in a general way decay is recognised as being a dry rot or a wet rot. The amount of moisture in the clamp is probably very important in determining the nature of the rot. If dry conditions are maintained, species of saprophytic *Fusarium* may develop. In a dry, well-ventilated clamp, bacterial decay tends to be checked, and unless a large percentage of blighted tubers is present no great injury follows. If, however, moister conditions prevail, especially if accompanied by warmth, bacterial decay on a large scale may commence. In this case the decay is usually of the nature of a wet rot. The bacteria are probably common saprophytic species such as *B. subtilis*, *B. vulgatus*, *B. mesentericus* and *B. fluorescens*, which attack the blighted tubers and spread to those which are sound (unblighted), gaining entrance through wounds, abrasions, and perhaps also lenticels (breathing pores). If a vertical section of a clamp containing a number of such blighted tubers be made, it is easy to see the watery mass of bacteria flowing down from diseased tubers on to sound ones, and, in the case of those in actual contact, bringing about, at all events in some instances, their infection.

During an inspection made in Lincolnshire last January several bad cases of a dry rot due to *Phytophthora* were observed, notably in the varieties British Queen and Arran

Chief. The bulk of the cases examined were, however, due to a wet rot following blight. Much heat was given off owing to respiration of the tubers, and this, coupled with the moist state of the crop when clamped and the hastiness with which it was necessary to put on the soil coverings, afforded ideal conditions for bacterial decay.

(2 and 3) Frozen and Flooded Tubers.—Tubers which have been killed or damaged by frost or flooding are readily attacked by saprophytic bacteria. The subject of bacterial decay through submergence in water has been studied by Wehmer. The first step is stated to be a pectin-fermentation which dissolves the middle lamella of the cell-walls, thus setting free the cells one from another and leading to the formation of a white, mealy pulp. Wehmer was unable to identify the bacterium causing the decay, but doubtless several species may occur. This rot develops both under water and in tubers removed from the water and exposed to air. At a later stage other bacteria become active. Such decay takes place at ordinary temperatures, but is hastened if the temperature is raised. Tubers injured by frost would probably behave in the same manner (*see under "Frost,"* p. 53).

(4) Blackleg.—Blackleg is a disease which occurs in the growing crop and causes a black, wet decay at the base of the stems, especially in early summer. The disease spreads to the tubers and causes rotting (*see* p. 36). It has been clearly shown by Pethybridge that under damp conditions perfectly sound potatoes may be infected through the lenticels with the blackleg bacillus, and develop the characteristic rot. Tubers produced by plants which suffered from blackleg are, therefore, a source of danger in the clamp, since each diseased tuber may serve as a centre from which the rot may spread to the surrounding healthy ones, and there is a risk of the whole pit being rendered useless. Such decay is very greatly accelerated if the temperature is high. The blackleg bacillus itself dissolves the middle lamella of the cell-wall, and prepares the way for further decay by other organisms.

It has been stated by Paine, Appel, and others that blackleg disease attacking a crop towards the end of the season may show so little manifestation above ground that it passes entirely unnoticed, and in a crop thus attacked the only sign of disease is a slight brown discoloration of the vessels of

the tuber at the heel end. The inclusion in the clamp of such diseased tubers might lead to the most disastrous results.

(5) **Wet Rot due to Heating.**—Although bacterial decay takes place at ordinary temperatures, it is greatly hastened by heat. The heating of the clamp through the respiration of the tubers (*see* p. 55) would, therefore, unless there was ample ventilation, greatly increase the activity of all the common saprophytic organisms, and result in more speedy decay of blighted, dead, and injured tubers. In addition to this it is known, especially from the researches of van Hall, that at a temperature of about 95° F. the common saprophytic bacteria, *Bacillus subtilis* and *B. vulgaris*, become pathogenic to various plants, amongst others the potato. It was found that sound tubers, if inoculated through a wound with pure cultures of *B. subtilis* and kept at a temperature of 100° F., completely decayed after four or five days. The bacteria dissolve the middle lamella, the enzymic action taking place in advance of the organism itself. The cells are killed, but the starch grains remain for a long time intact. This *B. subtilis* rot shows as a brownish or greyish discoloration, and has an alkaline reaction; it emits a characteristic smell, chiefly of trimethylamin and ammonia. A very similar rot is caused by *B. vulgaris*, but the colour and smell are somewhat different.

A further form of bacterial decay was described by Schuster. The organism in this case, *Bacillus xanthochlorum*, forms a yellow alkaline rot, smelling strongly of ammonia. Though the tubers decay readily at ordinary temperatures the growth of the bacillus is greatly favoured by heat, the optimum temperature being about 95° F. In addition to dissolving the middle lamella, *B. xanthochlorum* is stated to possess other enzymes which ferment starch.

Another point which should be noted in connection with bacterial decay is the fact that the tissues of sound tubers may be locally injured by the ammonia which is liberated from rotting tubers. The action of bacteria may thus indirectly account for the destruction of further tubers.

Apart from the action of bacteria, potato tubers are known to be liable to injury by physical conditions. When investigating the trouble known as "Blackheart" (a blackening in the centre of the tuber), Bartholomew showed that this malady could be produced at will by subjecting tubers to a temperature of 100° to 113° F. for 14-48 hrs., and quite recently Stewart and

Mix, in America, have demonstrated that a similar pathological condition could be produced at a much lower temperature if air were excluded.

With regard to the areas inspected last winter the occurrence of bacterial decay unassociated with blight was found to be exceptional. Cases did occur, however, in clamps where excessive heating (120°—150° F.) had been produced, and many of the tubers had been killed by the heat. No cases of typical blackheart were observed, but the above experiments indicate the danger which results from lack of ventilation and even moderately high temperatures.

(6) **Fusarium Rot.**—The rot caused by the fungus *Fusarium caerulcum* (which should not be confused with the common saprophytic species usually referred to *F. solani*) is essentially a storage rot, its effects being particularly noticeable in spring (see p. 39)

Pethybridge showed that the fungus, though usually a wound parasite, can attack uninjured tubers through lenticels, eyes, and young sprouts, and also that liability to infection is very largely influenced by the degree of maturity of the tubers. His infection experiments proved that there was a progressive susceptibility to rot, and that the maximum was reached early in the new year, when 100 per cent. successful inoculations could be obtained. Early varieties are very much more subject to attack than others, and in bad cases at least one-third of the crop may be lost.

(7) **Frost.**—The usual appearance of tubers which have been frozen is so well known that no description is necessary. Bacterial decay and a wet rot follow rapidly on thawing, though much of the moisture visible on the surface of a frozen tuber is doubtless due to the direct action of the frost.

From the observations of Müller-Thurgau it would appear that the actual freezing point of the potato tuber is 30° F., but freezing of the tissues does not readily take place unless the tuber is cooled to 27° F. Solidification of the watery contents of the tuber then takes place, and the temperature rises again to 30° F. Tubers have been kept for 14 days at a temperature between 30° F. and 28° F. without their becoming frozen, and it is maintained by Appel that if the temperature within the clamp is kept above 28° F. there is no risk of loss through frost.

It is well known that potato tubers kept at low temperatures become sweet, owing to the conversion of starch into sugar. This is not caused by the injurious action of frost, as is commonly supposed, but is an example of a phenomenon common amongst plants, which has been shown, especially by the Swedish botanist Lidforss, to be of great significance in the case of green leaves in winter, in that it preserves them from the injurious action of frost. The sugar not only lowers the freezing point of the sap in the cells of the leaf but diminishes the injury when actual freezing takes place. In the case of the potato tuber the transformation of starch into sugar has been proved to occur at several degrees above 32° F., and the production of sugar on nearing the freezing point has doubtless a protective importance in the tuber as it has in the case of green foliage.

II. CAUSES OF HEATING IN A POTATO CLAMP.—It is well known that, when potatoes are lifted and put into a pit or clamp, more or less heating takes place, and for this reason it is customary, if weather permits, to leave the straw coating uncovered for about a fortnight to allow the heat to escape. It may be assumed that in all cases where falling in of clamps has occurred great heating had taken place, though with the collapse of the clamp much of the heat is liberated. Recent examination of heated clamps before collapse showed that a temperature of 120° F. was common and 140° F. not infrequent, whilst in extreme cases 154° F. and 160° F. were recorded. Such temperatures are the more remarkable since the clamps, though undoubtedly not too well ventilated, were not completely "covered in," *i.e.*, the straw layer along the ridge was more or less exposed.

The size of the heated clamps was usually rather large and the highest temperature was found, as might be expected, not far from the top of the clamp, the distance observed being 18 in. or a foot. The tubers in this area were rotten, many being literally cooked. Where decay had not proceeded far it was found that below this level the heat very rapidly decreased.

The production of heating in the clamp is brought about mainly by two causes, *viz.*:—(1) the physiological process of respiration, or breathing of the tubers, (2) the action of micro-organisms, or the "breaking down" of the substance of the tubers by action of fungi and bacteria, the latter being the more important.

(1) **Respiration** (a) *Normal Respiration*.—Plant respiration being chemically a process of oxidation, is accompanied by the evolution of heat. As all parts of the living plant respire, it is evident that a certain amount of heating, due to the normal respiration of tubers, must take place. Respiration is greatest when the vital functions of the plant are most active, and hence growing tubers respire more vigorously than those which are mature, but the process continues as long as the tubers remain alive. Respiration is, moreover, more active in high than in low temperatures, and would, therefore, apart from the ripening of the tuber, tend, under normal conditions, to diminish steadily as the winter advances, and later commence to increase when the rise of temperature augments the vital activity of the tuber. The total amount of heat developed by normal respiration when masses of potatoes are pitted or clamped must be very considerable, and if not conducted away by ventilation would lead to a material rise in the temperature of the clump.

(b) *Injured Tubers* --It is well known that cut and wounded tissues of plants respire for a time more actively than the same tissues before injury, and the case of potatoes has been especially investigated by Richards, who gives figures showing the increased amount of carbon dioxide evolved per hour. The intensified respiration accompanies the extra activity of the protoplasm in repairing the injuries by means of wound cork, which is formed beneath cut surfaces and tracts of broken cells. The presence, therefore, of cut and broken or even bruised tubers would lead to some additional heating, but although this would perhaps not amount to many degrees it may not be unimportant as a factor contributing towards the initial heat which provides conditions suitable for the growth of saprophytic bacteria.

(c) *Unripened Tubers*.—A second and probably more important factor in intensifying respiration is the presence of young or immature tubers in the clump. In mature tubers the cells are well packed with starch, and the chemical changes concerned in ripening have ceased, but in immature tubers such changes are still in progress and hence respiration will proceed with greater activity.

The presence in a clump of a large number of immature tubers, or tubers which have developed late growth would for this reason give rise to additional heat. Owing to the wet September of 1918, the potato haulms kept green

longer than usual and a large amount of late growth in the tubers was very manifest. This late or "secondary" growth is exhibited in various ways, according to the variety of potato, viz., supertuberation in Arran Chief, elongation of the tuber in British Queen and King George, hollowness in Great Scot, and cracking in King Edward, Royal Kidney and Majestic. It is probable that the presence of this late and immature growth was very largely responsible for a considerable amount of the general extra heating which in some districts occurred last season.

(d) *Sprouting of the Tubers*.—When the temperature of a clamp rises sprouting of the tuber takes place. Such growth respire very vigorously, as was shown by Devaux about thirty years ago. The heat liberated further raises the temperature and this in turn encourages further growth and greater respiration. There is thus a tendency, if the ventilation of the clamp is not good, for progressive heating to take place. Extensive sprouting and the production of a matted mass of young shoots was general in all the heated pits examined. This vigorous growth would assist in raising the temperature and materially hasten any bacterial decay that had started, though when once the latter had become vigorous it would be a source of further heat and would therefore stimulate the growth of uninjured potatoes.

In connection with respiration another fact of practical importance may be pointed out. The more actively tubers respire the more oxygen they absorb. Consequently, in a clamp which has become heated more oxygen is used up, and ventilation which might at first have been sufficient may prove to be inadequate for the more rapidly respiring tubers and shoots.

(2) **The Action of Micro-Organisms**.—As in the heating of haystacks micro-organisms (*i.e.*, fungi and bacteria) are largely responsible, so in the case of potato clamps their activities must be regarded as highly important. The micro-organisms themselves respire, but in potato pits the amount of heat evolved in this way is probably insignificant compared with that due to the processes of decay which they bring about. In the case of hay, and doubtless also in potato clamps, a series of organisms are involved, one species succeeding another as the optimum temperature for each species is reached.

The common saprophytic bacteria, such as *Bacillus subtilis*

and *B. vulgaris*, already referred to, play an important part in the preliminary stages of the decay and fermentation of the tubers. In these cases, however, it is usually the middle lamella that is first attacked, the cell-wall itself remaining untouched. Other bacteria follow and produce further decay. There can be little question that in the case of potato tubers the chief bacterial heating is derived from the fermentation of the starch grains, and that the potential amount of heat represented by the abundant starch-content of the potato is very large indeed.

With regard to the excessively high temperatures found in many of the clamps there can be practically no doubt that this is due to the presence of thermophilic (heat-loving) bacteria. It is impossible to account for it by the respiration of the shoots and tubers, the death temperature of these being considerably below 150° F. Thermophilic bacteria, with limits of temperature between 100° F. and 158° F., have been isolated from hay, and are the dominant organisms present at the higher temperatures. Here anaerobic fermentation (*i.e.*, fermentation in the absence of air) takes place and the heat produced is sometimes so great that spontaneous combustion results. It is highly probable that in certain parts of poorly-ventilated clamps anaerobic conditions exist, and that, though their presence has not yet been definitely proved, thermophilic bacteria are actively at work.

III. CONDITIONS FAVOURING HEATING.—The production of heat described in the above section is largely dependent upon the presence of two conditions: (1) moisture, and (2) lack of ventilation.

Moisture is especially important in connection with bacterial decay. The normal respiration of a dormant tuber is possibly independent of atmospheric moisture, though for the production of growth through sprouting this is necessary. For the development of bacteria the presence of water is essential, especially in the initial stages of infection and decay. Bacterial action will commence on cut and bruised surfaces and in blighted tubers, but it will extend rapidly under damp conditions, such as would be provided by the pitting of wet tubers and the inclusion of those which had been frozen or flooded.

Ventilation however, is the master factor. A free circulation of air dispels both heat and moisture. Lack of ventilation, through retaining heat and moisture, favours heating both

by respiration of tubers and bacterial decay. Other points, such as the exclusion of blighted or diseased tubers of various kinds are most important, but even if all these are rigidly excluded regard must be paid to the proper ventilation. This is largely a practical problem concerning the clamp, its size, construction, date and thickness of covering, etc., details which obviously vary with the locality.

IV. PRACTICAL SUGGESTIONS.—Several conclusions of practical bearing may be drawn from the above resumé.

1. The *condition of the tubers* at clamping time is important. They should be put away in a dry state and as free from soil as possible. Moisture favours bacterial decay and soil hinders ventilation, hence the heat does not escape. Injured tubers, since they cause extra heating and serve as centres for the commencement of decay, should not be included more than can be helped. It is most important also to exclude, as far as practicable, all blighted tubers. There can be little doubt that where blighted tubers are present in quantity, 10 per cent. or above, they may not only seriously decay themselves, but are a source of danger to others. Tubers likewise which have been frozen or flooded should not be clamped. If any doubt exists, or if a certain proportion of tubers are believed to be injured, they should not be put in the main clamp, but might be pitted separately. The same advice applies to harrowings which are apt to be badly injured or touched with frost. Potatoes which have produced late growth or are still "green" (*i.e.*, immature) are particularly liable to heat. Special care is, therefore, necessary in the case of such a crop and subsequent inspection of the clamp should be made at intervals. Where blackleg has been present every precaution should be taken to reject all diseased or doubtful tubers.

2. With regard to the *structure of the clamp** the following points should be borne in mind. Large clamps are liable to develop more heat than small ones, hence it is false economy to build them excessively large. Although when other conditions are favourable potatoes may sometimes keep well in a large clamp, as a general rule it is unsafe and inadvisable for the base to exceed 7 ft. In many parts of the country a smaller size is customary. The site should be dry and well drained, and the base, if anything, slightly above the general soil level.

* The structure of a well made potato clamp is shown in Fig. 19. See also p. 22.—*Editor*.

The soil covering should not be put on too soon. If the weather is fine and there is no appearance of severe frost, a full fortnight should elapse between "strawing" and closing in with the first covering of the soil. This allows much of

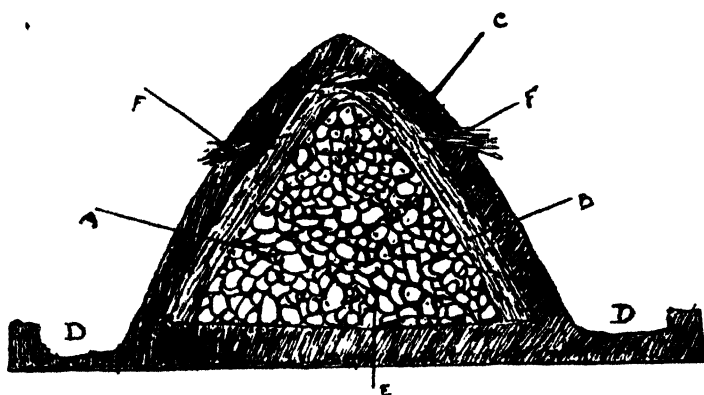


FIG. 19.

- A. Potato Tubers stored in a Heap.
- B. Layer of Clean Straw covering Potatoes.
- C. Layer of Soil covering Straw.
- D. Drain dug round the Heap or Potato Store.
- E. Showing Potatoes resting on Ground Level.
- F. Ventilation by Bunches of Straw.

the early heat (produced by respiration) to escape. In very wet weather the soil may be put on sooner, as it is inadvisable to close in when the straw is sodden with water. In putting on both the first and the second or "winter coat," the north side should receive first attention.

3. The necessity of *ample ventilation* is most marked. In a general way it may be said that in the early part of the winter there is more risk of damage through overheating than from frost. Adequate top ventilation must, therefore, be given. The straw should be left exposed along the ridge, and not completely closed in. A good method is completely to protect the north side, but to leave about 10 in. open on the south. Except in the coldest localities the winter coat need not completely cover the ridge, but an extra covering of litter (such as loose straw) is advisable.

4. *Periodical inspections* during autumn and winter should be carried out. Where there is much disease and decay it may be necessary to reclamp. The potatoes should be dressed and the ware and seed reclamped separately. When heating is taking place one or other of the following methods of ventilation should be adopted:—

- (1) A series of ventilation holes should be made about 1 ft. square along the bottom on both sides of the clamp. At the same time the whole ridge of the clamp should be opened out. The bottom of the ventilation holes should be so sloped that rain runs away from, and not into, the clamp.
- (2) The soil should be removed from the side of the clamp in strips, 1 ft. wide, extending from the ridge to the base on both sides of the clamp at distances of every 10 yards, or, on the south side only, at distances of 5 yards. The ridge of the clamp should also be opened out. If severe weather sets in, these ventilation spaces should be filled with straw.

PRACTICAL HINTS ON POTATO SPRAYING.

There should now be no necessity to impress upon growers the fact that spraying pays. Continued experiments have shown that on an average of a series of years spraying has increased the yield of sound potatoes by approximately two tons per statute acre ; while in a bad season the neglect of this operation often means the loss of a large proportion of the crop.

THE CARE AND USE OF KNAPSACK SPRAYING MACHINES. Internal Pump Machines.—Remove spraying nozzle ; pump clean water through the hose in order to remove dirt ; wash the tank out thoroughly.

Oil the three bearings of the crank shaft ; rub the leather shoulder straps with oil to prevent cracking.

External Pump Machines.—Wash out as above ; oil all working parts. To secure the smooth working of the pump and prevent the washers from hardening rub them with oil after use ; to obtain access to the pump washers unscrew the top of the pump valve.

Unscrew the caps of the two screw valves at the base of the machine ; clean and oil balls at frequent intervals.

For lubricating, use good machine oil ; do not use paraffin. If spare parts are needed order them at once.

When filling the machine pour the mixture carefully through the strainer to ensure that no particles of dirt get into the tubes and nozzles.

When the machine is on the back adjusted for use, before the tap is turned on, make several strokes with the pump in

order to secure sufficient pressure to throw a very fine mist. Remember that it is necessary to coat both surfaces of the leaves with a fine film of the mixture.

Immediate steps should be taken to procure suitable wooden barrels for mixing purposes, and care must be taken to see that these are thoroughly clean. Tar or paraffin barrels should be carefully cleaned and all traces of tar removed.

Councils, Allotment Associations and other bodies should arrange for labour to be trained in good time, so that the spraying will be carried out efficiently.

In an average season an approximation to the following dates for the first spraying of second early and main crop potatoes will probably be satisfactory:—

Cornwall	June 15th—end of June.
Devon	N.B.—Spraying should be done the last week of May for early varieties in the Penzance district and the first week of June in other forward districts of Cornwall, Devon, and the Isle of Wight.
Dorset	
Isle of Wight and Hampshire..	
Somerset	
S.W. Wales	
Glamorganshire	July 1st—July 8th.
Gloucestershire	
Monmouthshire	
N.W. Wales	
Sussex	
Wiltshire	July 8th—July 15th.
Berkshire	
Herefordshire	
Kent	
Oxfordshire	
Surrey	July 15th—July 31st.
Worcestershire	
Remainder of country	

(In the north-eastern counties spraying should usually be deferred until the last week of July.)

The second spraying should generally be done about three weeks after the first. It will serve to cover the new foliage and to protect more completely that already sprayed. In the south-west of England it will often be found advisable to spray a third time, and this applies also to other districts in wet seasons when heavy rains are frequent.

INSTRUCTIONS FOR MAKING BURGUNDY MIXTURE.—The mixture should be carefully made, otherwise injury to the foliage may result. It is essential that all the soluble copper be precipitated by the addition of sufficient soda. Whilst adding the soda to the solution of copper sulphate the mixture must be vigorously

stirred. The precipitate formed by the mingling of these two substances should be flocculent and should remain in suspension for a considerable time.

For Spraying $\frac{1}{3}$ Acre (say 50 rods).

1. Dissolve 4 lb. of sulphate of copper in 5 gallons of water in a barrel capable of holding 40 gallons, then add water to make up to 35 gallons.

N.B.—Iron or zinc vessels must not be used.

2. Dissolve in another vessel in 5 gallons of water 5 lb. of washing soda (previously broken up into small pieces if necessary).
3. When the soda is *completely* dissolved, add (2) to (1), stirring vigorously meanwhile.

N.B.—Both copper sulphate and soda should be of fully 98 per cent. purity.

Where smaller areas are to be sprayed, barrels capable of holding 10 gallons may be used; in that case the quantities of copper sulphate and soda given above should each be reduced to $\frac{1}{3}$, namely, 1 lb. of sulphate of copper and $1\frac{1}{3}$ lb. of washing soda.

Burgundy mixture should be bright blue in colour, and should not settle for a considerable time. Experience has shown that the precipitate remains longer in suspension and adheres better to the foliage when the mixture is made up in the above manner than when the soda is added to a concentrated solution of copper sulphate. The fungicide should be used in a *fresh state* and in no case should it be applied more than 10 hours after it has been made.

Sulphate of Copper is poisonous, therefore the vessels in which the copper compounds have been prepared should not be used for the preparation of food.

Opinions differ as to the relative value of Bordeaux and Burgundy mixtures; there is, however, no doubt that both are efficient fungicides. Where freshly-burnt stone-lime of good quality is to be obtained the use of Bordeaux mixture is to be recommended; but where good lime is not readily to be had, Burgundy mixture should be used.

INSTRUCTIONS FOR MAKING BORDEAUX MIXTURE.—This mixture should be made up in the following proportions:—

Copper sulphate	..	..	..	..	4 lb.
Quick lime (freshly burnt lumps)	..	..	..	..	2 lb.
Water	..	..	..	..	40 gal.

The copper sulphate should be dissolved in 35 gallons of water in a barrel. The lime should be placed in a separate vessel and slaked *slowly*. This is best done by adding only the amount of water which the lime can absorb. After the lime is thoroughly slaked, more water should be added *gradually*, stirring all the time, to make up to five gallons. It should

then be strained through a fine sieve and added to the solution of sulphate of copper, the contents of the barrel being vigorously stirred during the mixing.

CULTIVATION OF LANDS—SPRAYING OF POTATO CROPS TO PREVENT DISEASE.—It is hoped that the Councils of Boroughs and Urban and Rural Districts and Parishes will help by purchasing spraying machines, if not already in possession of them, with the necessary chemicals, and hire them out for use by the small holders and cottagers in their respective districts, where possible arranging for the spraying to be carried out by a competent operator.

REPORT ON THE POTATO SPRAYING TRIALS, 1918.

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A. INTRODUCTION.—In 1917, the Food Production Department of the Board of Agriculture and Fisheries carried out an extensive campaign to encourage the spraying of the potato crop, and, at the end of the season, a report was compiled which summarised the opinions expressed as to the value of this measure. Few statistical data of a definite character were, however, then obtainable, so the Department decided to institute a number of trials in 1918 with a view to obtaining more explicit information on the value of spraying in different parts of the country, as a means of controlling potato blight.

Arrangements were made for the trials to be carried out on a uniform plan as far as possible. The trials were conducted in four series. In Series I and II, only trials of the simplest nature were attempted, Series II differing from Series I in being conducted on a larger scale, and with better facilities for supervision. Series III were trials made in manufacturing districts with a view to determining to what extent scorching occurs after spraying, and, if possible, how it can be obviated. Only a few trials, however, were carried through completely in this series. Finally, in Series IV., an extensive group of experiments, conducted chiefly at agricultural research stations, was designed to test under strict conditions not only the spraying mixtures commonly in use, but also these modified either by the use of substitutes for washing soda, by the

addition of adhesive substances, or by using different proportions of soda.

With few exceptions these trials were carried out on small plots one or two rods in size, the spraying being done with knapsack machines. The trials were duplicated when possible, and control plots were always kept. Arrangements were also made for certain trials on larger areas in the Fens with horse-drawn machines, and the results of these have already been described in the January number of the Board's *Journal* (p. 1166). The varieties of potatoes chiefly used in these trials were King Edward and the Up-to-date class. Every effort was made to ensure uniformity in the quality of the seed.

On account of war-time difficulties, the trials at some places had to be abandoned, or were rendered of little or no value, through shortage of labour at the time of lifting. A large number were, nevertheless, carried through successfully.

Course of the Epidemic.—As is well known, the development of potato blight in epidemic form is dependent upon weather conditions. In 1918, the weather was dry during June and the first half of July, in most parts of the country, after which heavy rain fell at intervals over a long period. With the exception of a few isolated outbreaks, blight did not appear epidemically in the south of England until the beginning of August, being thus considerably later in development than in 1917. In north-west Wales, however, the disease appeared extensively somewhat earlier. The haulm was most severely attacked in Wales, south-west England, the Thames valley, and the Fens, but in other parts blight was often not sufficiently severe to afford a good test of the value of spraying.

At the end of September, the amount of blight in the tubers was considerably less than in September, 1917, it being exceptional to find 5 per cent. of the crop blighted even when unsprayed, but the continued wet weather of the autumn greatly delayed lifting, and in the Up-to date class, and to a less extent in Arran Chief and in King Edward, blight often spread considerably in the crop before clamping.

B. RESULTS OF THE TRIALS. (1) **General**—The majority of the results obtained were favourable to spraying, particularly in the west and south. On account of the difficulty of obtaining soils of a uniform character throughout the experimental area, it is obvious that the experimental error in such trials is of considerable magnitude, especially where the trial is not duplicated. Due account was, however, taken of any obvious

difference between the soil of the sprayed and the unsprayed plot, or when any other exceptional condition prevailed.

In most of the trials the average gain of sound tubers in favour of plots sprayed more than once was about $1\frac{1}{2}$ tons per acre. Where blight was epidemic, the haulm of varieties susceptible to this disease, which had been sprayed at an opportune time, remained healthy about 3-4 weeks longer than where unsprayed, thus allowing a longer period of growth for the tubers.

Notwithstanding the care taken in preparing the mixtures, the results of spraying were unfavourable in certain instances, which were more frequent in the north than in the south. These losses were sometimes due to the haulm being damaged through spraying, especially in the variety King Edward growing in the vicinity of large towns. This variety is known to be particularly sensitive to the action of spraying fluids when not grown under the best conditions, but there is no danger in spraying it in country districts. Some of the losses, however, cannot be accounted for in this way, and an explanation must be sought in other directions. The effect of soil differences might sometimes overbalance gains due to protection from blight, and if spraying were not done at the most favourable time, the factor due to experimental error might be greater than the protection afforded from blight.

In certain cases the weight of blighted tubers in the sprayed plot was greater than in the control, especially with susceptible varieties of the Up-to-date class, notwithstanding which the yield of sound tubers was still in favour of the sprayed plot. This increase in diseased tubers may be accounted for partly by the longer period during which the tubers are liable to infection by spores falling from blight spots on the leaves—unsprayed foliage being killed more rapidly—and partly by the tubers having grown larger by the time infection occurred.

(2) Burgundy versus Bordeaux Mixture.—Many more trials were carried out with Burgundy than with Bordeaux mixture, not because the former was considered to be better, but because washing soda was more readily procurable in many parts of the country than lime of good quality. Both mixtures adhered well to the foliage, and gave good results generally, but in smoky districts there was a little evidence that Bordeaux was less likely to cause scorching than Burgundy mixture. With the exceptions referred to below, both Burgundy and Bordeaux mixtures were made up in accordance with the in-

structions given in the leaflet of the Board of Agriculture and Fisheries.*

(3) Number of Applications.—Three sprayings gave the best results and two sprayings were superior to one in most cases, though a single late application sometimes proved more effective than two earlier sprayings. A single application given at any considerable interval before blight was beginning to develop epidemically did not prove satisfactory.

(4) Time of Spraying.—This is of great importance and in a season like 1918 much of the spraying in the south-west was done too early to be effective. In certain parts it was only the relatively late third spraying which had protective value. The time of spraying must be considered in connection with the number of applications. It is usually possible to spray effectively three times with a knapsack, but with a horse-drawn machine the state of the haulm often precludes this. To a great extent both the number of sprayings and the time of application must be left to the judgment of the grower.

(5) Strength of the Spraying Mixture.—In these trials no appreciable increase of sound tubers was obtained in general by spraying with a two per cent. instead of a one per cent. mixture, and this conclusion agrees with the results obtained in Ireland over a period of years. Except, perhaps, in very wet districts a one per cent. mixture gives as good results for all practical purposes as a two per cent. mixture, and, of course, is less costly. In any case it is probably better to spray three times with a one per cent. mixture than twice at double the strength.

(6) Use of Burgundy Mixture containing greater Amounts of Soda than usual.—Burgundy mixtures containing 6 and 7 lb. of soda, instead of the usual 5 lb. per 40 gallons, were found not to result in injury to the foliage except in one case, and in smoky districts the use of larger amounts of soda tended to reduce the danger of scorching.

(7) Dry Spraying.—The results were usually not so good as when wet mixtures were applied, but where water is difficult to obtain or labour has to be economised, dry spraying should be resorted to, rather than that spraying should be omitted, if blight is liable to be severe. To be effective, dry spraying should be done when the dew is on the leaves.

(8) Use of Substitutes for Washing Soda.—Soda ash and similar

* See Leaflet No. 23, *Potato Disease*.

substances, which are practically washing soda without the water of crystallisation, were used with success instead of washing soda crystals for making Burgundy mixture. Growers who use these substitutes should, however, obtain from the manufacturers a guarantee as to the proportion in which these are chemically equivalent to washing soda for making Burgundy mixture.

(9) **Use of Adhesives.**—The incorporation of various adhesives, *e.g.*, soft soap, soap powder, and glue, with the spraying mixture was tried, but without any considerable gain in adhesiveness. Even if a substance were discovered which appreciably increased the adhesiveness without greatly raising the cost, the difficulty of incorporation might render its practical applicability uncertain.

(10) **Proprietary Substances.**—Some of the best known of these were tried on a limited scale and, judging by the results of a single season, the different brands vary considerably in adhesiveness and, therefore, also in efficiency.

(11) **Scorching.**—Fewer complaints of the haulm being damaged by spraying with Burgundy or Bordeaux mixture were received than in 1917, partly doubtless because greater care was taken in making the mixtures and partly because the haulm was generally much less affected by aphides than in the previous year. Most cases of scorching occurred in the vicinity of towns with a polluted atmosphere, where the potatoes were growing under unfavourable conditions.

C. OTHER FACTORS WHICH INFLUENCE THE PREVALENCE OF BLIGHT.—It is well known that certain varieties are more susceptible to blight than others, and it is probable that too little attention has been paid to this matter in the past. Of the varieties grown on a large scale, British Queen and the Up-to-Date class are very susceptible to blight both in the haulm and the tubers. The former is usually lifted early, but, in spite of this, frequently becomes blighted in store. On the other hand, President (including Scottish Farmer and Iron Duke), and to a less extent Evergood, are resistant to blight, although their quality is not first class. Most other commercial varieties, *e.g.*, King Edward, Arran Chief, Great Scot, Golden Wonder, etc., are of an intermediate character and may be classed as susceptible to blight, although the degree of susceptibility varies with the particular stock, seed fresh from Scotland being often less severely attacked than home-saved seed. In this connection, mention may be made of the fact that, in 1918, in the West of

England, unsprayed fields of Scottish Farmer sometimes remained green for some weeks after sprayed fields of King Edward and Up-to-date had been severely attacked by blight.

Soil and situation have also a marked influence upon the degree to which a crop may be attacked by blight, crops on low-lying, sheltered land being more liable to severe attack than on exposed or gently undulating land. Blight is most virulent in the south and west (including Wales) and in the Fens. It is noteworthy too, that potatoes in large urban districts are often less affected by blight than in country areas, and in the former, particularly in the midlands and the north, it is doubtful whether it pays to spray, especially when the risk of scorching the haulm in a smoky atmosphere is taken into account.

As regards blight in the tubers, the time of lifting is, of course, important. During the wet autumn of 1918, probably more tubers became diseased during one week of October than in the whole of the previous month.

In considering, therefore, the means of controlling a disease like potato blight, many factors are involved, of which one is the protection afforded by spraying. The majority of varieties generally pay to spray in those parts where blight is virulent, and where the spraying is done at an opportune time ; but some varieties rarely pay to spray.

ORMSKIRK POTATO TRIALS.

Annual Report, 1918.

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INTRODUCTION.—The potato trials conducted by the Board of Agriculture and Fisheries were continued at Ormskirk during the season 1918.* The primary object of the trials is, of course, the testing of varieties in order to ascertain whether they are immune from wart disease. Up to the present 363 varieties have been tested. Of these 105 have proved immune from the

* Report on Immunity Trials at Ormskirk, 1915-16-17, F. P. Leaflet No. 21.

disease and 243 have been found to be susceptible. In the case of 15 varieties no definite decision has been reached and for the present they are classified as being of doubtful immunity. Each variety tested has been carefully described, and this has brought into prominence the question of synonyms and types. A complete alphabetical list of all the varieties tested, classified as Immune, Non-Immune and Immunity Doubtful has now been included in the report.

The only remedial measure tested this season was steam sterilisation, but the results were negative. Thus the planting of immune varieties still remains the only known method of obtaining satisfactory crops from infected land.

In the preface of his book, "The Horse-Hoeing Husbandry," Jethro Tull made the following statement and suggestion:—

"Every man is best satisfied with experiments made by himself; therefore I advise him, who intends to practise, that he would repeat the trials of all mine before he relies upon them, not that I have been unfaithful in the making or relating of any of them (for I only made them in search of the truth)"

This applies equally to the Ormskirk trials. It is not suggested that growers should test varieties for immunity, but that the immune varieties should be tested by growers in all infected districts in order that they may ascertain the cropping powers, resistance to ordinary disease, cooking qualities and suitability for local markets, and thus arrive at a definite decision as to the varieties best suited to the district.

During the past season the Board have had a number of varieties tested at 36 centres. The results of these tests will be published as a separate report. The Lancashire County Council have for two years conducted a number of field trials,* the Glamorgan County Council have tested a number of varieties under garden or allotment cultivation, and tests have been made by allotment associations and private growers.

It is only by co-operation of this kind that the Board's efforts in combating what is, perhaps, the most serious disease that has ever attacked potato crops in this country can be brought to a successful issue.

SITE OF THE 1918 TRIALS.—Through the kindness of the Ormskirk Board of Guardians the farm attached to the Poor Law Institution was again placed at the disposal of the Board. Trials of previous seasons have proved that this land is thoroughly infected by the spores of *Synchytrium endobioticum*, the fungus

* Report of Field Trials with Varieties of Potatoes (Farmer's Bulletin No. 31). T. Milburn, Ph.D., N.D.A., and R. Richardson, N.D.A.

producing wart disease. The field on which Plots Nos. 1-88 were situated was clover ley in 1917, but the other fields were planted with potatoes in 1917. The small field, in which Plots Nos. 89-128 were situated had not been previously used for variety trials. The land was found to be rather uneven in character, some small patches being very sandy, and on this account, the results, as far as yield is concerned, are not strictly comparable and must not be regarded as representing, accurately, the relative merits of the different varieties.

WEATHER CONDITIONS.—During the spring and early summer, the rainfall was very low. At the time of planting the soil was very dry, and the light sandy land of the trial grounds when planted in such a condition rarely becomes sufficiently moist during the whole of the growing season. The rain, instead of penetrating the soil, appears to run off the surface of the ridges, and collects at the bottom of the furrows. Even after the heavy rains of August the soil in many parts was found to be very dry. The early and some of the second early varieties, such as King George and Arran Comrade, had begun to ripen before the heavy rains of August came. From the third week in August until the third week of October, there were only 5 days on which no rain fell. This greatly interfered with the work of lifting and recording, which was not concluded until the third week of November.

TREATMENT OF THE LAND.—The land received a dressing of 12 tons of stable manure and the following quantities of artificial manure per acre :—

4 cwt. Superphosphate.
1½ „ Sulphate of ammonia.
¾ „ Sulphate of potash.

A slightly heavier dressing of sulphate of potash would have been given had more been available. The manures were applied in the drills at the time of planting.

PLANTING.—Planting was commenced on the 16th April, and was concluded on the 11th May, with the exception of the varieties Bloomfield, Laing's Prolific and Duchess of Buccleuch, which did not reach the trial grounds until the end of May. All varieties were planted at a distance of 27 in. between the drills and 15 in. between the sets. All the larger tubers were cut before planting, the percentage of cut tubers varying with the sample of "seed" sent for trial. In only one case was there evidence that cutting in any way affected the crop. The exception was Seedling 3 M.T. (Dobbie).

SIZE OF PLOTS.—In the case of new varieties arrangements were

made for planting 14 lb. and the area of the plots was 1/140 acre. In a few instances smaller quantities were planted. The demonstration plots of the chief immune varieties were larger, and varieties such as Ally, Great Scot and Majestic covered $\frac{1}{4}$ acre.

LIFTING.—Lifting was commenced as soon as the varieties were mature, but, owing to weather conditions, was not completed until the middle of November.

VARIETIES PLANTED.—Of the total number of stocks planted this season, namely 301, the great majority were supplied free of cost by various firms, or by raisers or growers, whose names appear in the tabulated results. The thanks of the Board are due to those who co-operated in sending "seed" to Ormskirk for trial. Purchases were made of certain stocks of well-known susceptible varieties, and in a number of instances different stocks of the same variety were intentionally planted.

Summary of Results.

(a) Stocks of immune varieties previously tested ..	128
(b) Stocks of well-known susceptible varieties planted for control purposes	14
(c) Stocks of varieties not previously tested or of doubtful immunity in previous trials	159
	<hr/>
	301

The actual number of varieties not previously tested was 151, but as stocks of the same variety were entered by different firms the number of plots was 159. The varieties which had not previously been tested gave the following results :—

Proved immune	30
Immunity doubtful	5
Susceptible	116
	<hr/>
Total	151

The question of synonymous varieties will be referred to later, but it might be noted that, of 30 which proved immune, 12 were types of previously-tested immune varieties.

PURITY OF STOCKS.—The "rogues" present in the stocks sent for trial are assumed to be actual impurities and not bud variations of the variety. Usually such "rogues" are easily identified as belonging to some well-known variety which has

become mixed with the stock sent for trial. In these trials it is essential that the stocks to be tested should be pure, because when planted on infected land the "rogues," if they are of a susceptible variety, develop Wart Disease, and as a result the immunity of the variety is at once called in question. All stocks which were sent early enough were boxed and sprouted, and such "rogues" as were then observed were selected and planted separately. During the growing season each plot was carefully inspected several times and all "rogues" were marked by means of canes.

It is very satisfactory to observe that the stocks sent for trial and demonstration purposes this season have, in the majority of instances, been reasonably pure.

The following plots call for special notes:—

Edzell Blue.—Only an occasional "rogue" was found on these plots. The most common impurity in this variety is *Fortyfold*, and sometimes *Lord Tennyson*, a coloured potato splashed with white.

King George.—A small percentage of "rogues" present, these were almost exclusively *British Queen*.

Abundance.—One stock obtained from Ireland consisted largely of *Up-to-Date*.

Culdees Castle.—This stock contained 25 per cent. of an early variety, probably *Sharp's Express*.

Burnhouse Beauty.—The stock on Plot 66 contained a small percentage of "rogues."

Snowball.—The stocks of *Snowball* on Plots Nos. 86 and 87 were not true to name, being chiefly *Abundance*.

White City.—The stock on Plot 120 contained a number of *Up-to-Date* "rogues."

Invincible.—This stock contained 33 per cent. of *Champion*.

Snowdrop.—The stock grown on Plot No. 136 contained a high percentage of *Up-to-Date*.

Stephenie I. and Stephenie II.—These stocks were mixed.

Early Gem.—This was a very mixed stock.

Walker's Regent.—This stock was not true to name but was composed of *Great Scot* and *Eclipse*.

Banff Favourite.—Three types were present, one of which was *Champion*.

Seedling No. 20 (Mila).—Appeared to contain two types, one an *Up-to-Date* and the other a *President*.

VARIATIONS.—In the variety *Edzell Blue*, tubers are frequently found which in shape are not typical. They are long cylindrical tubers (not strictly kidneys) often with a skin of much smoother surface than is usual. A number of these tubers were selected by Mr. J. L. Clucas and 45 sets were planted on the trial grounds. The foliage and flowers were true to the type of *Edzell Blue*, and when the crop was lifted only one tuber

was found resembling in shape those planted. All the others were the usual round tubers typical of the variety.

That a coloured variety may occasionally vary in its skin colour has often been observed. A common example of this is *King Edward*, in which tubers are sometimes found completely coloured pink instead of the pink coloration being around the eyes only. In past years this variant has been sent for trial under various names, and in each case the plants resembled *King Edward* in all details except skin colour. These stocks have always proved susceptible to wart disease, but until this season the tubers retained the colour of the sets planted. This year a coloured kidney potato was sent under the name of *Signet*, and at planting time it was noted that the variety was probably a coloured *King Edward*. The foliage was typical of *King Edward*. When lifted the tubers of the new crop were not completely pink, and had reverted to the typical colour of *King Edward*.

A curious colour "sport" was found in the variety *Princess Royal*. This variety is a coloured kidney, but one tuber was found in which one-half was white and the other half coloured, and the line of demarcation was very decided, as can be seen from the illustration (Fig. 24).

SYNONYMS.—(One of the greatest difficulties arising in large trials of this kind is due to the use of different names for the same variety, in other words the use of synonyms. In the first instance it must be candidly admitted that even where differences of foliage are evident it is often difficult, if not impossible, to define them. It may, however, be stated that a number of varieties, or so-called varieties, are morphologically identical in every detail although they may bear different names. It may be surmised that synonymous varieties may arise in three ways:—

1. The first case—the renaming of old varieties, or, as sometimes happens, the introduction of stocks of the same seedling by two different firms—is the simplest. For instance, it is generally admitted that *Iron Duke* is simply a selection from *President*, and morphologically, at least, in no way differs from that variety. A good example of the same seedling being put on the market through two distinct channels is that of *Tinwald Perfection* and *Rob Roy*. These varieties are identical, and through the kindness of Mr. A. W. McAlister, of Dumfries, it is known that *Rob Roy* is simply a part of the stock of *Tinwald Perfection* which had been overlooked by the raiser.

2. Several varieties tested in this year's trials as seedlings have proved to be botanically identical with *Up-to-Date*, and all have proved to be susceptible to wart disease. It might be presumed that such varieties were bred by raisers working independently of each other, but by chance using the same two varieties as parents. The information supplied by some of the raisers, however, makes this presumption exceedingly unlikely. To take only two examples; one of these types is said to have been produced by *British Queen* \times *Kerr's Pink* and another by *Up-to-Date* \times *Factor*. That two seedlings botanically identical could have been produced from parents so widely divergent in character does not appear probable.

3. It might also be presumed that as a result of "selfing" varieties already in cultivation, seedlings might arise absolutely identical in character with the parent. Two examples might again be taken from the group of *Up-to-Date* varieties. As stated above, one seedling is said to have been obtained from the cross *Up-to-Date* and *Factor*, whilst a second arose from the cross *Up-to-Date* and *Duchess of Cornwall*. It will be observed that in each case both parents are practically *Up-to-Date*. Does this mean that *Up-to-Date* "selfed" will produce *Up-to-Date*? Is it possible that these raisers have strains of *Up-to-Date* varieties which produce fertile pollen? This does not appear to be very probable.

It is not possible to determine from observations on the trial grounds which of these methods has given rise to the synonymous varieties sent for trial. The problem can only be solved by careful pedigree breeding, and the necessary information may already be in the hands of the breeders. In the *Gardener's Chronicle* of 10th August, 1918, the writer of the leading article, referring to the Ormskirk Trials and the question of synonyms, makes the following statement:—

"It (synonymity) is further complicated by the raising of new seedlings closely related in all characters to existing ones, but, perhaps, more vigorous with the strength of youth."

If this is a statement of fact and not an assumption then some synonymous varieties must undoubtedly be seedlings, and it may further be assumed that if certain seedlings differ from older varieties only in the "vigour of youth," then eventually seedlings will be bred differing from *Up-to-Date* only in the fact that they are immune from wart disease. It is interesting to note, however, that all the varieties similar

to *Up-to-Date* are susceptible to wart disease, as are the varieties similar to *British Queen*, but on the other hand the varieties similar to *Abundance* and those similar to *Great Scot* are all immune. "The vigour of youth" does not appear to be a very satisfactory character for distinguishing between varieties. Some of the so-called seedlings tested have displayed signs indicative of the decrepitude of old age.

TYPES NOTED IN 1918 TRIALS.

Epicure Type.—Earliest Challenger (Houlston).

Sharpe's Express Type.—Verdun, Comley's Seedling, an unnamed variety (Plot 219).

Duke of York Type.—Faithlie.

British Queen Type.—Bootle Gem, Macpherson's Early, Robson, Beachus' Early Giant, The Scot (?), Kerr's Early, Maid of Auchterarder, unnamed variety (Plot 223).

Up-to-Date Type.—Prosperity (Webb), Rent Payer, Jones' Cropper, Seedling (Plot 217), Irish King, The Barry, Wainwright No. 8, Autocrat, Alfred A. Lamont, Canadian, Kerr's Seedling, Glamis Beauty, Lord Dutterin, Seedling No. 9 (Miln), Nova Scotians, Duchess of Buccleuch (?), Drumwhindle Seedling.

Northern Star Type.—Aeroplanes, Allies, Ally No. 1 and No. 2 (sent by Messrs. Bees, Ltd.).

President Type.—Iron Duke, Scottish Farmer, Golden City.

Arran Chief Type.—Prosperity.

Abundance Types.—Osborne Seedling, Waverley, Balthayocks, Seedling No. 104 (Guthrie), Peace Abundance (Scarlett), Seedling No. 21 (Miln), Bloomfield, Laing's Prolific.

White City Type.—Carnegie.

Flourball Type.—Dargavel, unnamed (Plot 227).

Shamrock and Flourball (Sutton) appear to be identical.

Invincible and Champion Successor also appear to be identical.

Blue Peter, Brown's Purple and an *Unnamed Variety* (Plot 283) show no difference in characters.

The Mouswald and Bantam.—No difference between these varieties was observed.

Coronation (Gardiner) and *Crown Jewel* (Toogood).—No difference between these was observed.

Other types noted in previous trials are referred to in the List of Varieties at the end of the Report.

REMEDIAL MEASURES: STEAM STERILISATION.—Many experiments have been conducted for the purpose of discovering a fungicide that will kill the spores of the fungus in the soil. At the Harper Adams College, Mr. Malthouse tested a number of fungicides with no successful results*. At Ormskirk experiments have been carried out with lime, sulphur, soot, formalin, corrosive sublimate, etc., but none of the substances was successful in eradicating the spores of the fungus.

This year steam sterilisation of the soil was tested. It was suggested by the Hon. Rupert Guinness that this might possibly

* Wart Disease of Potatoes. Bulletin, Nov., 1910.

be a successful remedial measure. In order to make the test as thorough as possible and to prevent the soil becoming re-infected after sterilisation, the experiments were set up in large pots in a cage. All the pots were sterilised and every precaution was taken to prevent any chance of the sterilised soil becoming infected during planting. The potatoes used in the experiments were Scotch "seed" of the variety *Scottish Farmer* (or *President*) obtained from the same source. This variety is highly susceptible to wart disease.

The experiments were arranged as follows :—

- (a) One tuber was planted in each of three pots containing soil from a garden at Preston presumed to be free from wart disease.
- (b) One tuber was planted in each of three pots containing infected soil from the trial grounds.
- (c) One tuber was planted in each of three pots containing infected soil from the trial grounds which had been sterilised under a high pressure of steam for $1\frac{1}{2}$ hours.

The results (see Fig. 20) were as follows :—

- (a) The three plants were all free from any visible trace of the disease, thus indicating that the "seed" used in the experiments was not infected and that the results obtained in (c) were not due to any infection of the soil subsequent to sterilisation or due to the presence of spores on the "seed" when planted.
- (b) The three plants were all badly affected with wart disease, which was to be expected.
- (c) The three plants in the sterilised soil were all badly infected, every tuber being warted. It is evident from the photograph that the amount of wart on these plants was even greater than on the plants in (b). This probably does not mean that there was a greater degree of infection, but that the greater amount of wart present was due to the greater proliferation of tissue owing to sterilised soil having produced more vigorous plants. It is hoped to repeat this experiment next season.

TABULATED RESULTS.—As pointed out in the introductory remarks, the investigation of immunity and synonymity has in the past been the main purpose of these trials. They are not cropping trials, but at the same time every care has been taken to make the records of weight as accurate as possible. It will be noted that where several stocks of the same variety have been grown there is a fairly close similarity of results. This can be observed by a comparison of the weights obtained from the stocks of *Edzell Blue* or *King George*. It will be noted that all the stocks of *Majestic* gave only moderate results. The stocks of *Tinwald Perfection* and *Rob Roy* on Plots Nos. 69, 72, and 73 gave practically identical crops. The smaller

crop on Plot No. 70 is explained by the fact that the "seed" planted had been grown in Lancashire for two years.

In the immune variety records the riddle used had a $1\frac{1}{4}$ inch mesh, the "seed" and "ware" being the potatoes which passed over this mesh. Owing to the large number of varieties to be dealt with it was not possible to give the weights of the "seed" and "ware" separately.

In the records of the susceptible varieties the weights given are those of the tubers not visibly warted and of the warted tubers.

VARIETIES OF DOUBTFUL IMMUNITY.

No. of Plot.	Variety.	Description.	Name of Sender.
140	Early Market	W.R. 2nd early	W. Robertson, Perth.
153		W.R. "	Guthrie Bros., Fife.
186	Seedling U. 9	W.R. "	E. Mackelvie, Lamlash.
214	Seedling No. 9 (Innes).	W.O. "	John Mosson, Coupar Angus
258	Banff Favourite.	C.R. "	Dobbie & Co., Edinburgh.
231	Congo	C.K. "	A. W. McAlister, Dumfries.

* See List of Abbreviations on p. 83.

NOTES ON VARIETIES OF DOUBTFUL IMMUNITY.—Under the head of Doubtful Immunity are placed those varieties which have not been definitely proved to be immune in this year's trials. When the plots were lifted one or two tubers on one or two plants were found affected with wart disease, and it could not be decided that such plants were "rogues." All those showing the disease were destroyed and tubers from non-infected plants have been retained for testing next year.

Early Market.—Two stocks of this variety were tested. On Plot No. 153 no wart disease was observed, but on Plot No. 140 three plants showed traces of wart disease. A few tubers from stock No. 140 were also planted in a badly infected garden and one of these plants was affected with the disease.

Seedling U. 9.—No wart disease was found on the tubers at the time of lifting, but in the field notes made during the summer it had been recorded that the disease had been observed at the base of the haulm of one plant. It is possible that a mistake was made in the field notes.

Congo.—A similar case to Seedling U. 9.

Banff Favourite.—Three types were present in this stock distinct both in haulm and foliage. One type was practically identical with *Champion* and was immune from the disease; a round mottled type was also immune, but a round white-fleshed type was badly affected.

Seedling No. 9 (Innes).—Wart disease was observed on two plants.

SUSCEPTIBLE VARIETIES.

No. of Plot.	Variety.	Description.	Name of Sender.	Yield Per Acre.		
				Clean.	Warted.	Total.
				T. c.	T. c.	T. c.
160	Ashleaf (Myatt)	W.K. Early	Sutton & Sons, Reading	4 5	2 6	6 11
175	Cloverley	W.K. "	W. Stewart, Salop	4 5	0 18	5 3
208	Verdun	W.K. "	W. E. Evans	Only few tubers.		
216	Comley Seedling (Comley)	W.K. "	W. Treseder, Ltd., Cardiff.	6 6	0 19	7 5
219	Unnamed	W.K. "	J. Pilkington, Halsall	6 2	1 9	7 11
192	Faithlie	W.K. "	B. Reid, Aberdeen	2 8	1 8	3 16
193	Midsummer Early (Findlay)	W.K. "	A. Findlay, Fife	2 11	1 5	3 16
198	Ruby Queen	C.R. "	A. Findlay Fife	3 1	0 13	3 14
210	Pink Early	C.K. "	T. E. Rees, Glamorgan	5 6	0 16	6 2
235	Red Kidney (T. A. Scarlett)	C.K. "	T. A. Scarlett, Edinburgh	4 0	1 12	5 12
245	Earliest Challenger (Houlston).	W.R. "	John Houlston, Dumfries.	5 4	1 13	6 17
253	Early Pink Seedling	C.K. "	Alexander & Brown, Perth.	5 0	1 13	6 13
257	Early Ruser	W.K. "	Dobbie & Sons, Edinburgh	2 16	0 15	3 11
267	Life's Blue (Lang)	C.K. "	Dobbie & Sons, Edinburgh	Only few tubers grown.		
270	Industrie	W.R. "	Dobbie & Sons, Edinburgh	5 15	3 8	9 3
146	Bootle Gem (Grice)	W.O. 2nd Early	W. Grice, Bootle	8 11	3 8	11 19
154	McPherson's Early	W.O. "	Guthrie Bros, Fife	4 18	0 3	5 1
209	Unnamed Early	W.O. "	R. Roberts	Only few tubers planted.		
223	Second Early	W.O. "	R. Roberts	7 1	2 12	9 13
225	Robson (Gavin)	W.O. "	W. Smith & Sons, Aberdeen.	7 11	2 3	9 14
228	Early Giant	W.O. "	A. P. Beachus, Mansfield.	4 0	0 19	5 5
254	The Scott (Somerville).	W.O. "	Alexander & Brown, Perth.	4 1	0 18	4 19
256	Kerr's Early	W.O. "	Dobbie & Co., Edinburgh	8 19	2 6	11 5
260	Maid of Auchterarder.	W.O. "	" "	8 10	2 13	11 3
178	Dargill Gem	W.O. "	J. Gardner, Perth	4 3	2 10	6 13
179	Lord Ancaster (Gardner).	W.K. "	" "	3 14	2 9	6 3
190	Flounder	W.R. "	Dept. of Agric, Dublin	4 18	0 15	5 13
197	Queen of the Veldt (Findlay).	C.O. "	A. Findlay, Fife	3 13	4 1	7 14
215	Early Gem (Harris).	W.K. "	Harris Blackpill	3 10	2 8	6 18
218	Radium	W.K. "	J. Webb			
237	Seedling No. 6 (Wainwright).	W.K. "	O. F. Wainwright, Grantham.	6 14	2 11	9 5
240	Norwich Wonder	W.O. "	Daniel Bros, Norwich	3 3	2 14	5 17
247	Lord Tullibardine.	W.O. "	G. R. Sharp, Blackford	9 2	1 15	10 17
252	The Napier (Napier).	W.O. "	Alexander & Brown, Perth.	9 5	3 3	12 8
255	Princess Royal (Whyte).	C.R. "	Dobbie & Co., Edinburgh.	7 7	1 2	8 9
259	Culloden 1745	C.K. "	" "	3 12	0 10	4 2
290	Seedling No. 5 (Miln).	W.R. "	T. E. Miln, Warrington	7 15	1 9	9 4
161	Berwick Castle (Sutton).	W.R. "	Sutton & Sons, Reading	7 9	1 18	9 7
162	Windsor Castle (Sutton).	W.R. "	" "	5 15	2 6	8 1
163	Edinburgh Castle (Sutton).	W.K. "	" "	6 13	2 9	9 2
164	Drummond Castle (Sutton)	W.K. Late	" "	10 0	1 13	11 13
165	Gordon Castle (Sutton).	W.O. "	" "	5 4	1 19	7 3
166	Dover Castle (Sutton).	W.K. "	" "	6 13	3 5	9 18

* See List of Abbreviations on p. 83.

No. of Plot.	Variety.	Description.	Name of Sender.	Yield Per Acre.		
				Clean	Warted	Total.
167	Harlech Castle (Sutton)	W.R. Late ..	Sutton & Sons, Reading	T. c. 7 10	T. c. 2 9	T. c. 9 19
168	Braemar Castle (Sutton)	W.R. " ..	" "	11 4	1 5	12 9
169	Rehance (Sutton)	W.K. " ..	" "	7 14	1 6	9 0
57	New Queen (Gray)	W.O. Early main crop.	T. A. Scarlett ..			
130	Cumberland Ideal (Thompson).	W.R. Late ..	J. E. Bockbank, Carlisle.	1 11	3 18	5 9
131	Cumberland Ideal	W.R. " ..	Daniels Bros. (ex Hobbies, Norwich)	1 7	3 15	5 2
132	Prosperity (Webb)	W.R. " ..	Daniels Bros. ..	1 13	3 11	5 4
138	Prosperity (Webb)	W.R. " ..	Poad & Sons, York ..	3 9	5 4	8 13
137	Prosperity (Webb)	W.O. " ..	Webb & Sons, Stourbridge.	8 3	5 10	13 13
155	Rent Payer ..	W.O. " ..	Clarke Bros., Carlisle ..	7 6	4 18	12 4
173	Jones' Cropper (English).	W.O. " ..	J. F. Williamson Co. Cork.	11 10	4 13	16 3
174	The Student (Wilson).	W.O. " ..	J. M. Roger, St. Andrew's Fife.	8 5	2 18	11 3
217	Seedling ..	W.O. " ..	W. Treseder Ltd., Cardiff	6 12	2 8	9 0
222	Irish King (Wheatley).	W.O. " ..	Barr & Sons ..	8 10	3 8	11 18
224	Drumwhundle (Gavin).	W.O. " ..	W. Smith & Sons, Aberdeen.	10 2	3 9	13 11
226	The Barry ..	W.O. " ..	G. Miles ..	10 12	2 8	13 0
238	Seedling No. 8 (Wainwright)	W.O. " ..	O. F. Wainwright Grantham.	2 19	1 5	4 4
239	Autocrat (Mills)	W.O. " ..	Daniels Bros., Norwich	1 0	0 16	1 16
246	Alfred A. Lamont (Houlston).	W.O. " ..	J. Houlston Dumfries	7 15	2 15	10 13
251	Canadian ..	W.O. " ..	R. Morris, Coupar Angus	7 4	4 11	11 15
262	Kerr's Seedling	W.O. " ..	Dobbie & Co., Edinburgh.	11 6	4 4	15 10
264	Glamis Beauty (Jack).	W.O. " ..	" "	11 3	3 7	14 10
274	Lord Duferin ..	W.O. " ..	W. R. Farish, Dumfries.	6 12	3 10	10 2
291	Seedling No. 9 (Mills)	W.O. " ..	T. E. Mills, Warrington.	8 17	4 2	12 19
292	Seedling No. 20	W.O. " ..	" "	8 13	3 1	11 14
293	Nov & Scotians	W.O. " ..	Summer & Leivesley Ormskirk.	9 16	1 15	11 11
300	Duchess of Buccleugh	W.O. " ..	C. Yeo, Bridgend ..	5 15	1 0	6 15
204	Northern Star (Findlay)	W.R. " ..	D. Bowe & Sons, Dunbar.	5 0	1 5	6 5
203	Albes ..	W.R. " ..	G. R. Sharp, Blackford	3 13	1 10	5 8
202	Albes ..	W.R. " ..	A. Findlay, Auchtermachty.	3 1	1 13	4 14
145	Acroplanes ..	W.R. " ..	Wm. Robertson, Perth	10 10	3 3	13 13
212	Ally No. 2 ..	W.R. " ..	Bees, Ltd., Liverpool ..		Only few tubers planted.	
213	Ally No. 1 ..	W.R. " ..	" "		Only few tubers planted.	
236	Seedling No. 4	W.R. " ..	O. F. Wainwright, Grantham.	3 12	0 15	4 7
157	Black Watch (Bruce & Robbie)	W.R. " ..	Bruce & Robbie, Forfar	4 16	2 10	7 6
170	Princess May ..	W.R. " ..	Alf. Drummond, Perthshire.	3 15	6 16	10 11
171	Controller (Drummond)	W.R. " ..	" "	6 8	1 10	7 18
172	Robbie Burns (Drummond)	W.R. " ..	" "	4 16	5 8	10 4
181	Stephenie 1 ..	W.R. " ..	J. Gardiner, Perth ..	3 3	1 9	4 12
182	Stephenie 2 ..	W.R. " ..	J. Gardiner, Perth ..	1 11	1 11	3 2
207	Seedling No. 16 (Farish)	W.K. " ..	W. R. Farish, Dumfries		Only few tubers planted.	
229	Golden City (T. Wilson)	W.R. " ..	W. J. Campbell, Dalkeith.	5 12	1 15	7 7
250	General (Thomson)	W.R. " ..	R. Morris, Coupar Angus	4 15	4 10	8 14
273	The Julian (W. R. Farish)	W.O. " ..	W. R. Farish, Dumfries.	7 4	2 3	9 7
273	The Tank (W. R. Farish)	W.O. " ..	" "	3 15	2 17	6 12
150	Invincible ..	W.R. " ..	Warden & Stewart, Belfast.	4 7	5 19	10 8

* See List of Abbreviations on p. 83.

No. of Plot.	Variety.	Description.	Name of Sender.	Yield Per Acre.		
				Clean.	Warted	Total.
151	Champion	W.R. Late	Hogg & Robertson	T. c. 3 14	T. c. 6 13	T. c. 10 7
180	Successor.					
180	Dargill Kidney (Gardiner)	W.K. "	J. Gardiner Perth	3 5	2 4	5 9
184	Yielder (Gardiner)	W.K. "	"	3 5	2 10	5 15
194	Langholm Model (Findlay)	W.K. Early Main-crop	A. Findlay	5 0	3 6	8 6
284	Langholm Model	W.K. "	Sumner & Levesley Ormskirk.	9 2	4 3	13 5
196	Hibernia (Findlay)	C.R. Late	A. Findlay, Auchtermuchty	3 3	1 3	4 6
200	Seedling 858 (Findlay)	W.O. "	"	5 6	6 10	11 16
201	Seedling 868 (Findlay)	W.K. "	"	3 9	3 15	7 4
234	Bantam (Scarlett)	W.R. "	T. A. Scarlett Edinburgh	6 3	2 12	8 15
275	The Mouswald (W. R. Farish)	W.R. "	W. R. Farish, Dumfries.	6 6	5 7	11 13
241	Future Fame (Daniels)	W.K. "	Daniels Bros., Norwich	3 14	2 13	6 7
242	Potato 316 (Poad)	W.K. "	Isaac Poad & Sons, York.	10 1	5 2	15 3
243	Emperor	W.R. "	"	9 12	2 5	11 17
248	E. M. Seedling	W.K. "	G. R. Sharp, Blackford.	"	0 4	"
249	Pink Seedling	C.R. "	"	10 10	1 0	11 10
261	No. 3 M.T. (Dobbie)	W.O. "	Dobbie & Co., Edinburgh.	2 18	0 5	3 3
266	D. 1 (Jack)	W.R. "	"	5 4	2 0	7 4
267	D. 2 (Jack)	W.O. "	"	10 7	0 10	10 17
268	No. 16 M.T. (Dobbie)	W.R. "	"	5 9	1 8	6 17
271	M.C.M.T.	W.K. "	"	Only few tubers planted.		
277	Seedling 472 C/2	W.R. "	Wotherspoon & Donald, Glasgow.	2 12	0 19	3 11
280	Canadian Snow	W.R. "	Sumner & Levesley, Ormskirk.	8 7	4 1	12 8
281	Magnificent (Findlay)	W.O. "	"	6 13	3 11	10 4
283	Unnamed New Variety	C.R. "	"	7 13	3 4	10 17
286	Brown's Purple	C.R. "	A. W. McAlister, Dumfries.	16 17	3 15	20 12
287	Signet (Wyllie)	C.R. "	"	7 17	2 5	10 2
288	Blue Peter (W. Kerr)	C.R. "	"	11 16	2 3	13 19
294	Crown (Clucas)	W.R. "	J. L. Clucas, Ormskirk.	Crop a failure owing to leaf curl.		
129	Arran Chief (Mackelvie)	W.R. "	G. R. Sharp, Blackford.	2 5	5 12	7 17
133	Summut	W.R. "	A. W. McAlister, Dumfries.	4 16	5 1	9 17
134	President	W.R. "	Purchased	5 10	3 6	8 16
135	Scottish Farmer	W.R. "	G. R. Sharp, Blackford.	5 11	3 1	8 12
136	Iron Duke (Brown)	W.R. "	J. Brown	4 12	3 11	8 3
141	Epicure	W.R. Early	A. W. McAlister, Dumfries.	6 15	1 12	8 7
144	Midlothian Early	W.K. "	"	8 13	0 12	9 5
206	King Edward	W.K. Late	G. R. Sharp, Blackford.	5 3	1 13	6 16
230	Ninetyfold	W.K. Early	A. W. McAlister,	4 2	2 6	6 8
232	Eclipse	W.O. 2nd early	"	2 6	2 15	5 1
265	Ewme Red (Jack)	C.R. Late	Dobbie & Co., Edinburgh.	5 15	2 12	8 7

* See List of Abbreviations on p. 83.

NOTES ON SUSCEPTIBLE VARIETIES.—The lifting and weighing were carried out under most adverse conditions this season owing to the constant rain. It was a difficult task to free the soil from the tubers of some of the more highly susceptible



FIG. 20.—Photograph illustrating results of Steam Sterilisation of Infected Soil. For explanation see text.

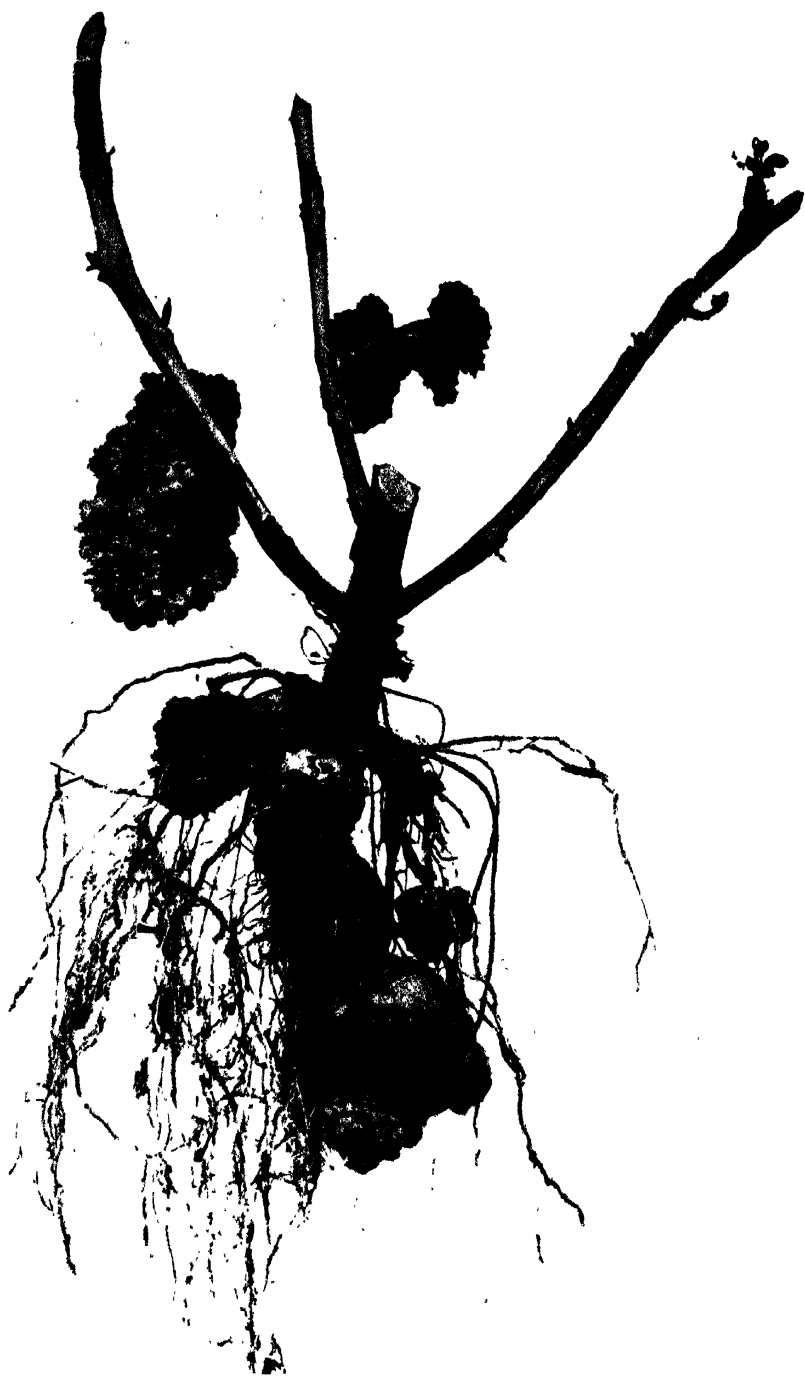


FIG. 21.—Plant of *Cumberland Ideal*.
Showing Loss resulting from planting this Highly Susceptible Variety on Infected Land. The two Warts on the Stem appear to be, in the one instance, a modified Leaf, and in the other, an aerial Tuber.

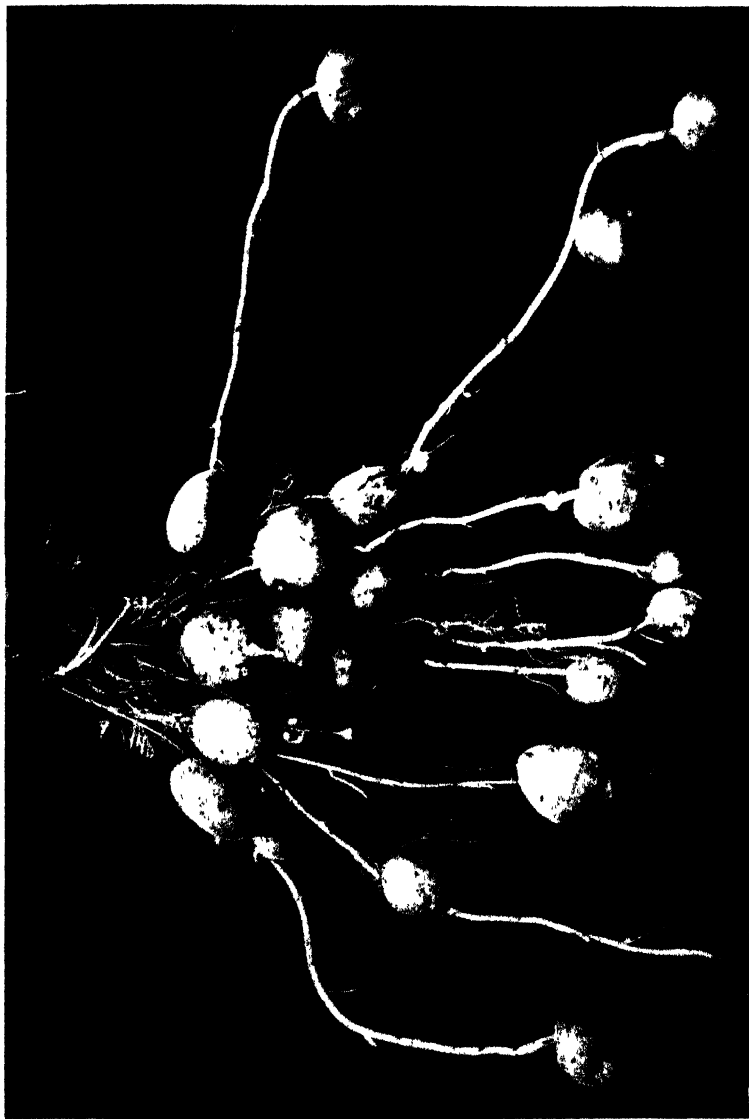


FIG. 22.—*Dominia*, showing Second Growth.



FIG. 23 —*Kerr's Pink*, showing Second Growth.

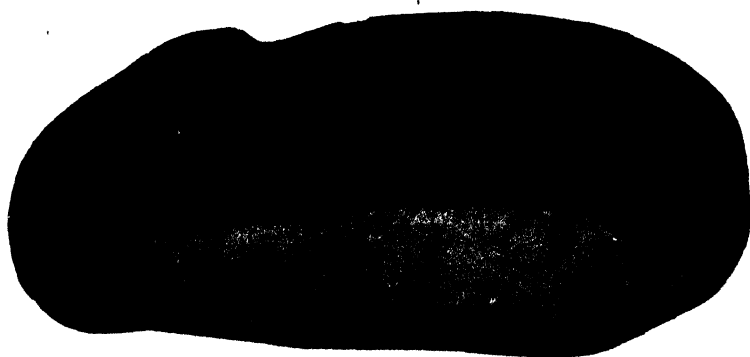


FIG. 24.—Parti-coloured Tuber of the variety *Princess Royal*.



FIG. 25.—*Leinster Wonder*, showing Masses of Fibrous Roots and Long Stringy Stalks.

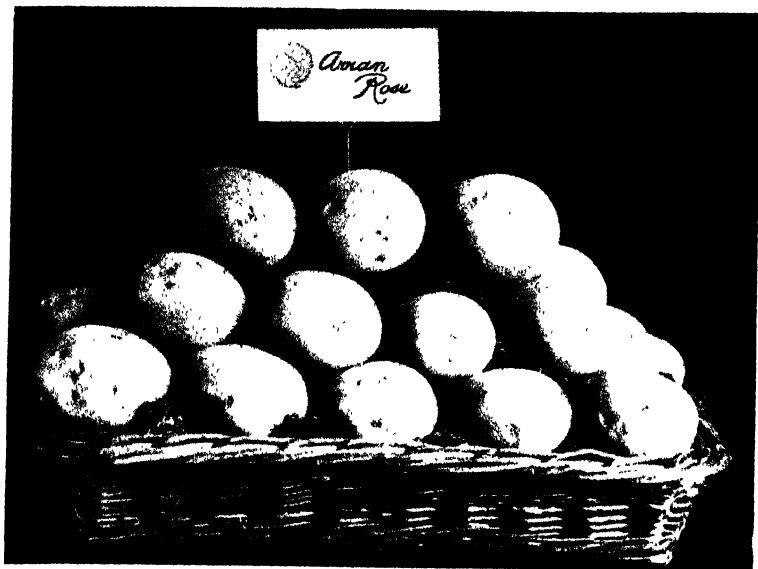


FIG. 26.—*Arran Rose* (Mackelvie).

This photograph was obtained from a basket of the variety kindly lent by Messrs. Dobbie & Co

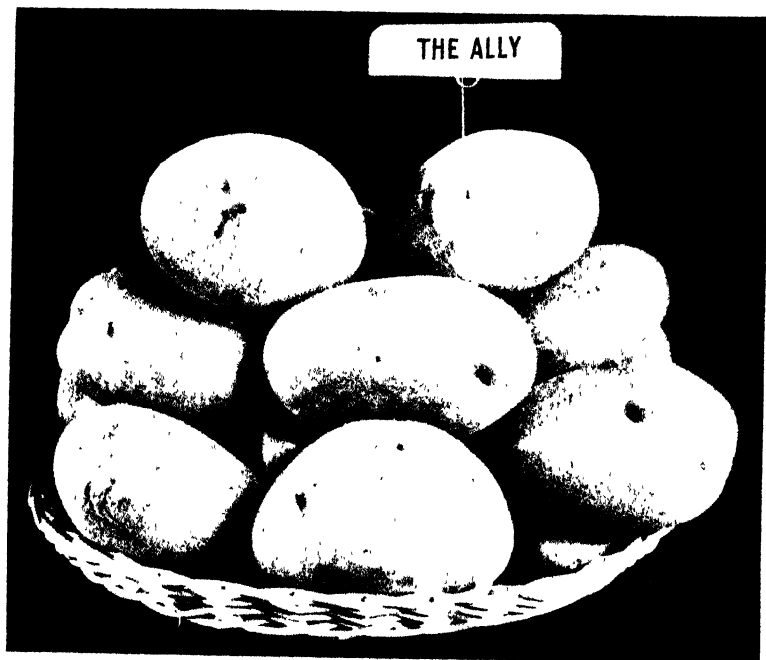


FIG. 27.—*The Ally* (Mackelvie).

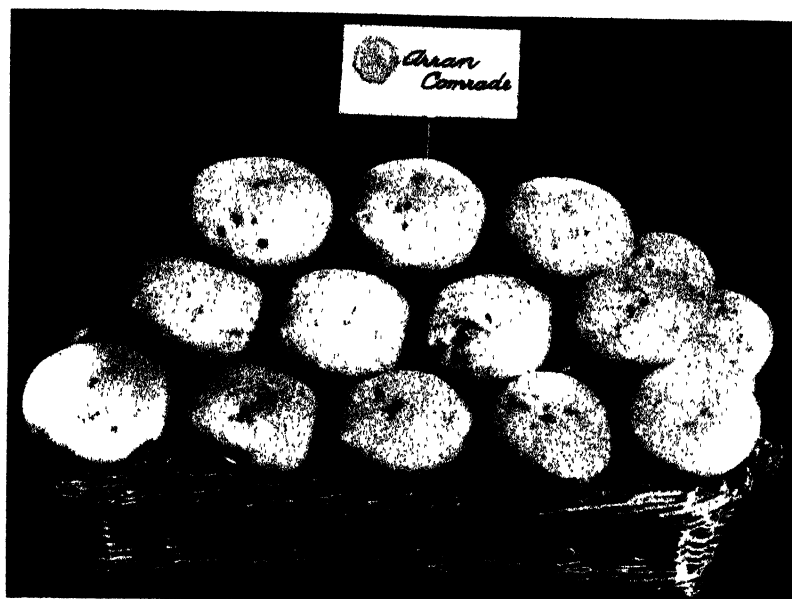


FIG. 28.—*Arran Comrade* (Mackelvie).

This photograph was taken from a basket of potatoes kindly lent by Messrs. Dobbie & Co.



FIG. 29.—*Tinwald Perfection* (Farish, W.R.).

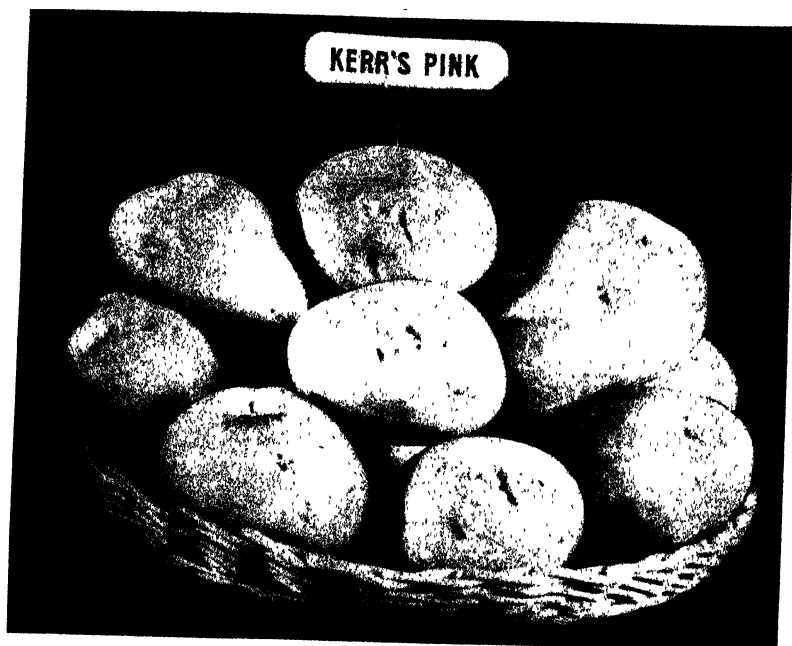


FIG. 30.—*Kerr's Pink*

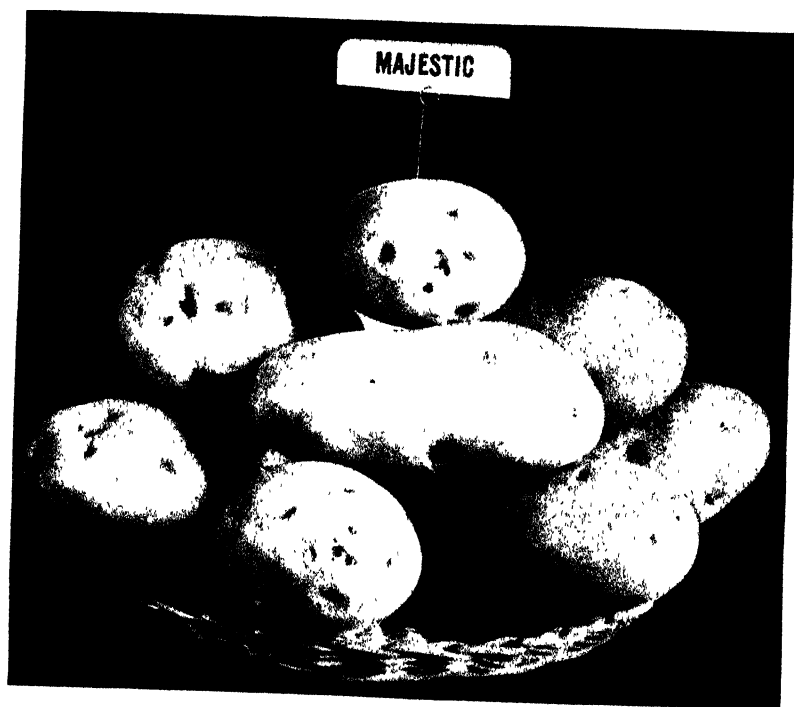


FIG. 31.—*Majestic* (Findlay).

varieties, and thus in some instances the weights may not be as accurate as could be desired.

Degrees of Susceptibility.—The weights as given in the above tables were obtained by selecting every tuber which showed the least visible trace of disease, and while it must be clearly understood that the tubers were not even examined with a pocket lens all varieties received the same amount of care. The proportion of warted to clean tubers varies considerably with the variety. To illustrate this the results obtained from the two stocks of *Prosperity* may be taken. The stock on Plot No. 138 was undoubtedly identical with that of *Arran Chief*, whilst on the adjoining, Plot No. 137, the stock was an *Up-to-Date* type. Both were vigorous, but the *Up-to-Date* stock gave the greater weight of crop. This may be accounted for by the fact that warts on *Arran Chief*, for some reason, decay much more rapidly than do those on *Up-to-Date*. Thus, when the crop is being weighed, it is quite impossible to collect all the putrid masses of *Arran Chief*. An examination of the weights of clean and warted tubers shows that in *Arran Chief* the weight of warted tubers is greater than the weight of tubers not visibly warted, or "clean," whereas on the *Up-to-Date* type the reverse is the case, the clean tubers being heavier than the warted tubers. *Arran Chief* was also growing on Plot No. 129, and it may be interesting to tabulate the results from these three plots. Of course, in making a comparison of this kind it is essential to select plots which were planted on the same day and lifted on the same day, and were practically adjoining, so that as far as possible the conditions of soil are the same. There was not another plot of an *Up-to-Date* type quite near, but for the sake of comparison, the nearest, *Rent Payer* on Plot No. 155, has been taken.

Plot.	Variety.	Clean Tubers. Per acre.	Warted Tubers. Per acre.	Total Crop. Per acre.
		T. cwt.	T. cwt.	T. cwt.
129	<i>Arran Chief</i>	2 5	5 12	7 17
138	<i>Prosperity</i> (<i>Arran Chief</i> Type) ..	3 9	5 4	8 13
137	<i>Prosperity</i> (<i>Up-to-Date</i> Type) ..	8 3	5 10	13 13
155	<i>Rent Payer</i> (<i>Up-to-Date</i> Type)	7 6	4 18	12 4

In all the other *Up-to-Date* types, the weight of visibly "clean" tubers is always greater than the weight of visibly warted tubers. The ratio between the weights varies in the different types, but this may be due to difference in time of planting, in time of lifting, and in soil. Of course, this

difference in the behaviour of *Arran Chief* and *Up-to-Date* might be accounted for in other ways. It may be due not to a difference in susceptibility but to a difference in the incidence of the disease, although insufficient evidence has been collected on this point to offer any opinion. Or, again, it may be due to the character of the potato. The wart is only the outward and visible sign of the disease; it is simply a proliferation of potato tissue, and the tissues of *Arran Chief* may respond more readily to the stimulus of the fungus.

Further observations must be made in this direction, and probably more accurate results could be obtained from pot experiments, in which soil differences could be eliminated. Whatever the explanation, however, it is interesting to note its relation of the characters mentioned above to synonymity, where the types have been planted and lifted on the same dates and where they have been grown sufficiently near each other to eliminate soil differences. This is brought out in the following table :—

Plot.	Variety.	Clean Tubers. Per acre.	Warted Tubers. Per acre.	Total Crop. Per acre.
(a)	Three adjoining Plots of <i>Cumberland Ideal</i> .	1. cwt.	T. cwt.	1. cwt.
130	<i>Cumberland Ideal</i>	1 11	3 18	5 9
131	" "	1 7	3 15	5 2
132	" "	1 13	3 11	5 4
(b)	Two Plots of <i>British Queen Type</i> .			
256	<i>Kerr's Early</i> (<i>British Queen Type</i>)	8 19	2 6	11 5
260	<i>Maid of Auchterarder</i> (<i>British Queen Type</i>)	8 10	2 13	11 3
(c)	<i>Invincible & Champion Successor</i> .			
150	<i>Invincible</i>	4 7	5 19	10 0
151	<i>Champion Successor</i> (similar to <i>Invincible</i>)	3 14	6 13	10 7
(d)	<i>President Synonyms</i> .			
134	<i>President</i>	5 10	3 6	8 16
135	<i>Scottish Farmer</i>	5 11	3 1	8 12
136	<i>Iron Duke</i>	4 12	3 11	8 3

It might be suggested that these results may be mere coincidences. Only further observations and experiments can definitely decide.

Loss from Planting Susceptible Varieties.—The loss from planting highly susceptible varieties on badly infected land is well illustrated by the varieties *Cumberland Ideal* and *Arran Chief*. On clean land both are heavy croppers, but the results given in the tables show that on infected land they give disastrous results.

The photograph of a complete plant of Cumberland Ideal (Fig. 21) shows to what degree of intensity wart disease is able to attack certain varieties.

In the tables of susceptible varieties there are the records of the weights calculated per acre for 147 acres. The total weight of warted tubers is 304 tons 15 cwt., an average loss of over 2 tons per acre. This is taking all varieties, first earlies included, but when we take such varieties as *Arran Chief*, *Cumberland Ideal* and *President*, the average crop of sound tubers will not exceed 3 tons per acre. This compared with the average crop of *Great Scot* and *Ally*, each over 13 tons per acre, shows a loss of 10 tons per acre, at present prices a loss of over £50 per acre.

Cumberland Ideal (Fig. 21).—This potato has proved one of the most highly susceptible of the varieties tested in 1918. It is very vigorous and crops well in Cumberland and Northumberland.

The Castle Varieties.—It is unfortunate that all these excellent varieties have failed to resist the disease.

The Allies.—This appears to be an example of the re-naming of old varieties. It is evident that *The Allies* is simply *Northern Star*, and therefore susceptible. It is much to be regretted that a name so nearly resembling *The Ally* should have been applied to a susceptible variety.

Bantam and Mouswald.—These appear to be identical. They are quite distinct from the *Up-to-Date* types.

Up-to-Date Types.—The majority of these types although susceptible to wart disease have cropped well, and it is evident that these varieties will yield good results on clean land.

ABBREVIATIONS.

W.R.—White Round.

C.R.—Coloured Round.

W.O.—White Oval.

C.O.—Coloured Oval.

W.K.—White Kidney.

C.K.—Coloured Kidney.

E.—Early.

S.E.—Second Early.

E.M.—Early Maincrop.

M.—Maincrop or Late.

DEMONSTRATION PLOTS OF PREVIOUSLY TESTED IMMUNE VARIETIES.

No of Plot	Variety.	Description.	Name of Sender.	Yield Per Acre.			
				Seed and Ware.	Chats.	Total.	
2	A. s (Sutton) ..	W R	Early ..	Sutton & Sons, Reading	T. c.	T. c.	T. c.
3	Dargill Early (Gardiner)	W.K	" ..	Plots 1915-6-7 ..	2 12	1 0	3 12
4	Dargill Early ..	W.K	" ..	Jas. Gardiner, Perth ..	4 10	0 7	4 17
5	Resistant Snow-drop (Dobbie).	W.K.	" ..	Plots 1915-6-7 ..	4 3	0 10	4 13
6	" ..	W K	" ..	Dobbie & Co., Edinburgh	5 8	0 12	6 0
7	" ..	W K.	" ..	Cross & Co., Wisbech	4 5	0 6	4 11
10	" ..	W.K.	" ..	J. L. Clucas, Ormskirk	4 18	0 9	5 7
11	Crown Jewel (Toogood)	W.R.	" ..	Plots 1916-7 ..	2 16	1 3	3 19
12	Edzell Blue ..	C R	" ..	Plots 1915-6-7 ..	7 17	0 12	8 9
13	" ..	C.R	" ..	Guthrie Bros., Fife	8 7	0 5	8 12
14	" ..	C.R	" ..	J. L. Clucas, Ormskirk	7 17	0 5	8 2
15	" ..	C.R	" ..	W Troughton, Preston	8 10	0 3	8 13
16	" ..	C.R	" ..	Sumner & Leivesley, Ormskirk.	9 3	0 4	9 7
17	" ..	C R	" ..	J Martland, Burscough	8 11	0 10	9 1
19	Arran Rose (Mackelvie)	C.O	" ..	I Poat & Sons, York.	5 8	0 12	6 0
21	America ..	W R	" ..	Dobbie & Co., Edinburgh.	3 17	0 11	4 8
22	King George (Gardiner)	W O	2nd Early	R Morris, Coupar Angus	7 11	0 8	7 19
23	" ..	W.O.	" ..	Sumner & Leivesley, Ormskirk	8 10	0 8	8 18
24	" ..	W.O	" ..	J L Clucas, Ormskirk	8 4	0 11	8 15
25	" ..	W.O	" ..	A. W. McAlister, Dumfries.	7 14	0 11	8 5
26	" ..	W.O.	" ..	Toogood & Sons, Southampton	7 13	1 0	8 13
27	Great Scot (McAlister)	W R	" ..	Sumner & Leivesley, Ormskirk	11 11	0 13	12 4
28	" ..	W R	" ..	R. Morris, Coupar Angus	13 11	0 11	14 2
29	" ..	W.R.	" ..	Cross & Co., Wisbech	9 0	0 15	9 15
30	" ..	W.R.	" ..	Clarke Bros., Carlisle	13 15	0 13	14 8
31	" ..	W.R.	" ..	B T Wilson, Staveley	15 0	0 6	15 6
32	" ..	W.R	" ..	G. R. Sharp, Blackford	14 3	0 5	14 8
33	" ..	W.R.	" ..	A. W. McAlister, Dumfries.	15 10	0 8	16 4
34	" ..	W.R	" ..	J L Clucas, Ormskirk	12 13	0 7	13 0
35	Southampton Wonder.	W.R.	" ..	Toogood & Sons, Southampton	12 17	0 14	13 11
36	Mt. Bresse ..	C K	" ..	A W McAlister, Dumfries.	6 0	0 7	6 7
37	Crimson Beauty	C K.	" ..	Toogood & Sons, Southampton	4 14	0 9	5 3
38	" ..	C K	" ..	A. W. McAlister, Dumfries.	5 8	0 14	6 2
39	The Dean ..	C.R.	" ..	Toogood & Sons, Southampton.	4 18	0 16	5 14
40	" ..	C.R.	" ..	A W McAlister, Dumfries.	5 18	0 12	6 10
41	Admiral ..	C.R.	" ..	Toogood & Sons, Southampton.	4 11	0 9	5 0
42	" ..	C.R.	" ..	A. W. McAlister, Dumfries.	7 11	0 14	8 5
43	The Towse ..	C.R	" ..	Dobbie & Co., Edinburgh.	4 13	0 14	5 7
44	Mauve Queen (Dobbie).	C.R.	" ..	No t weigh ed.			
45	The Ally (Mackelvie).	W.O.	" ..	A. W. McAlister, Dumfries.	13 10	0 12	14 2
46	" ..	W.O.	" ..	Wotherspoon & Donald, Glasgow.	11 14	0 9	12 3
47	" ..	W.O	" ..	G. R. Sharp, Blackford	11 11	0 11	12 2
48	" ..	W.O	" ..	Sumner & Leivesley, Ormskirk.	13 18	0 11	14 9
49	" ..	W.O.	" ..	R. Morris, Coupar Angus	14 0	0 11	14 11
50	" ..	W.O.	" ..	J. L. Clucas, Ormskirk	15 8	0 13	16 1
51	" ..	W.O	" ..	Cross & Co., Wisbech	11 0	0 16	11 16
52	Arran Comrade (Mackelvie).	W.O.	" ..	Poat & Sons, York ..	8 4	0 15	8 19
53	The Duchess (Dobbie)	W.R.	" ..	Dobbie & Co., Edinburgh.	7 11	0 19	8 10

* See list of Abbreviations on page 83.

No. of Plot.	Variety.	Description.	Name of Sender.	Yield Per Acre.		
				Seed and Ware.	Chats.	Total
54	Secundus (Dobbie)	W.O. Early Main Crop.	Dobbie & Co., Edinburgh.	T. c. 10 4	T. c. 0 16	T. c. 11 0
55	Abundance (Sutton)	W.O. " "	Sutton & Sons, Reading.	7 11	1 13	9 4
58	King Albert (Sands)	W.O. " "	Dept. of Agric., Dublin.	10 5	0 16	11 1
59	Culders Castle	W.O. " "	A. W. McAlister, Dumfries.	8 1	0 12	8 13
60	Unnamed	W.O. " "	Cross & Co., Wisbech	Not weighed.		
61	Favourite (Dobbie)	W.O. " "	Dobbie & Co., Edinburgh.	10 11	1 2	11 13
62	Jeane Deans	W.O. " "	A. W. McAlister, Dumfries.	10 3	1 8	11 11
63	The Admirer (Dobbie)	W.O. " "	Cross & Co., Wisbech	9 0	1 18	10 18
64	The Provost (Dobbie)	W.O. " "	Dobbie & Co., Edinburgh.	9 18	1 4	11 2
65	" "	W.O. " "	Sumner & Leivesley, Ormskirk.	11 13	0 18	12 11
66	Burnhouse Beauty (Dobbie)	W.O. " "	Dobbie & Co., Edinburgh.	8 16	0 9	9 5
67	" "	W.O. " "	Cross & Co., Wisbech	11 11	1 2	12 13
68	Domimon (Poad)	W.R. Late	Poad & Sons, York	11 5	1 8	12 13
69	Rob Roy (McAlister)	W.O. " "	A. W. McAlister, Dumfries.	12 16	0 16	13 12
70	" "	W.O. " "	J. L. Clucas, Ormskirk	9 2	0 12	9 14
71	Supreme (Sutton)	W.O. " "	Sutton & Sons, Reading	7 16	1 6	9 2
72	Tinwald Perfection (Farish)	W.O. " "	Dobbie & Co., Edinburgh.	12 15	0 14	13 9
73	" "	W.O. " "	Sumner & Leivesley, Ormskirk.	11 3	2 10	13 13
74	Lochar (Farish)	W.R. " "	Dobbie & Co., Edinburgh.	10 3	0 12	10 15
75	" "	W.R. " "	Wotherspoon & Donald, Glasgow.	13 18	1 3	15 1
76	" "	W.R. " "	Cross & Co., Wisbech	10 3	0 16	10 19
77	" "	W.R. " "	J. L. Clucas, Ormskirk	12 8	1 4	13 12
78	" "	W.R. " "	A. W. McAlister, Dumfries.	13 16	1 3	14 19
79	" "	W.R. " "	Sumner & Leivesley, Ormskirk.	9 0	1 4	10 4
80	Heather Bountiful (Erricks)	W.R. " "	Halsall & Erricks	14 1	1 10	15 11
81	Rhodene Lhu (Farish, S. F.)	W.R. " "	S. T. Farish, Lockerbie	10 15	0 17	11 12
82	Clan Alpine (Farish, S. F.)	W.O. " "	" "	9 9	0 12	10 1
83	Schoolmaster	W.R. " "	A. W. McAlister, Dumfries.	9 0	0 11	9 11
84	" "	W.R. " "	Sumner & Leivesley, Ormskirk.	9 0	0 18	9 18
85	Snowball (Carter)	W.R. " "	Carter & Co., "	7 11	0 16	8 7
88	Leinster Wonder (Williamson)	W.R. " "	J. F. Williamson, Mallow, Co. Cork	10 7	0 8	10 15
89	Champion	W.R. " "	Warden & Stewart, Belfast.	7 10	0 9	7 19
90	Champion	W.R. " "	Hogg & Robertson, Dublin.	7 5	0 11	7 16
91	Templar (Wilson)	W.R. " "	Cross & Co., Wisbech	8 11	0 11	9 2
92	" "	W.R. " "	Guthrie Bros., Ladybank, Fife.	8 11	0 18	9 9
93	" "	W.R. " "	Sumner & Leivesley, Ormskirk	9 0	1 4	10 4
94	" "	W.R. " "	J. L. Clucas, Ormskirk	8 1	1 0	9 1
95	Irish Queen (Strain)	C.R. " "	Warden & Stewart, Belfast.	6 16	0 16	7 12
96	" "	C.R. " "	Hogg & Robertson, Dublin.	6 1	0 19	7 0
97	Kerr's Pink (Dobbie)	C.R. " "	Dobbie & Co., Edinburgh.	14 14	0 4	14 18
99	Arran Victory (Mackelvie)	C.R. " "	Poad & Sons, York	9 19	0 14	10 13
100	Rector (Wilson)	C.R. " "	Guthrie Bros., Ladybank, Fife.	10 6	0 8	10 14
101	" "	C.R. " "	Cross & Co., Wisbech	8 15	0 9	9 4

No. of Plot.	Variety.	Description.	Name of Sender.	Yield Per Acre.		
				Seed and Ware.	Chats.	Total.
102	Shamrock ..	C.R. Late ..	Warden & Stewart, Belfast.	T. c. 4 10	T. c. —	T. c. —
103	" ..	C.R. " ..	Hogg & Robertson, Dublin.	6 6	0 17	7 3
104	Flourball (Sutton)	C.R. " ..	Sutton & Sons, Reading.	6 8	0 19	7 7
105	Flourball No. 2	C.R. " ..	"	6 9	1 3	7 12
106	" "	C.R. " ..	A. W. McAlister, Dumfries.	6 11	1 3	7 14
107	" "	C.R. " ..	Sumner & Levesley, Ormskirk	8 8	1 4	9 12
108	Majestic (Findlay)	W.K. " ..	A. Findlay, Auchtermuchty.	8 4	1 2	9 6
109	" "	W.K. " ..	Sumner & Levesley, Ormskirk	7 7	1 6	8 13
110	" "	W.K. " ..	Poad & Sons, York ..	7 11	1 16	9 7
111	" "	W.K. " ..	J. Martland, Ltd., Burscough.	7 0	1 3	8 3
112	" "	W.K. " ..	J. L. Clucas, Ormskirk.	6 3	0 14	6 17
113	" "	W.K. " ..	Dobbie & Co., Edinburgh.	4 19	0 11	5 10
114	" "	W.K. " ..	G. R. Sharp, Blackford.	6 5	0 17	7 2
115	" "	W.K. " ..	R. Morris, Coupar Angus	7 0	0 14	7 14
116	" "	W.K. " ..	Plots 1917 ..	3 8	0 13	4 1
117	Nithsdale (McAlister).	W.K. " ..	A. W. McAlister, Dumfries.	5 4	2 17	8 1
118	" "	W.K. " ..	Sumner & Levesley, Ormskirk.	6 4	3 5	9 9
119	St. Malo Kidney	W.K. " ..	A. W. McAlister, Dumfries	8 8	1 6	9 14
120	White City (Sutton).	W.K. " ..	" "	9 2	0 7	9 9
121	" "	W.K. " ..	Sutton & Sons, Reading.	10 0	0 11	10 11
122	Langworthy (Niven).	W.K. " ..	Warden & Stewart, Belfast	5 12	0 15	6 7
123	" "	W.K. " ..	Toogood & Sons, Southampton	6 6	1 0	7 6
124	" "	W.K. " ..	J. L. Clucas, Ormskirk.	6 4	0 8	6 12
125	" "	W.K. " ..	Sumner & Levesley, Ormskirk.	6 15	1 4	7 19
126	Golden Wonder (Brown).	W.K. " ..	J. L. Clucas, Ormskirk.	8 0	1 14	9 14
127	" "	W.K. " ..	Sumner & Levesley, Ormskirk.	4 4	1 2	5 6

* See list of Abbreviations on page 83.

NOTES ON PREVIOUSLY TESTED IMMUNE VARIETIES.—No trace of wart disease appeared on any of the immune varieties tested in previous years. Many stocks were far from vigorous, but it is evident that lack of vigour and susceptibility are not associated characters as is sometimes stated.

Weather conditions were probably responsible for the light crops of some of the early and second early varieties, e.g., low yield was particularly noticeable in the case of *King George*.

Second Growth or Supertuberation.—Second growth is most prevalent in seasons similar to 1918. The potatoes received a decided check owing to the drought of June and July, then the rains of August started the late varieties into growth again. The variety on which this phenomenon was most prevalent was *Dominion*. On the majority of the plants practically all the earlier-formed tubers gave rise to secondary tubers. This is well illustrated in Fig. 22. *Kerr's Pink* also

showed a large amount of second growth this year (see Fig. 23).

Second growth detracts from the value of the potato. The types of second growth illustrated have been observed only on round and oval varieties. On the Ormskirk grounds it has not been observed on *Great Scot*, although this is a round variety. In the kidney varieties, especially in the large tubers of *Majestic* and *White City*, second-growth results in the tuber splitting along its surface longitudinally. No instance of second growth of the type illustrated has been observed on true kidney varieties on the trial grounds.

A. 1 (Sutton).—This variety is evidently not suited for field cultivation.

Edzell Blue.—Observations this year have made it clear that *Edzell Blue* cannot, strictly speaking, be classed as a first early. When lifted early its quality is very moderate, but when allowed to mature its quality is quite good. Many plants produced a large number of small tubers on the surface of the hill around the collar of the plant. In all the cases investigated it was found that injury at the base of the stem, preventing the flow of sap down to the stolons was the cause of this defect. Rhizoctonia was probably the chief cause.

Dargill Early (Gardiner).—In previous trials this variety was grown under the name of *Gardiner's No. 1 Seedling*. It promises to be a useful early variety.

Arran Rose.—This variety was affected by the drought.

America.—The results obtained from this variety were very disappointing, but it matured very early owing to the lack of moisture.

Great Scot.—All the stocks of this variety were very uniform and vigorous. The average yield per acre of the 9 stocks (including *Southampton Wonder*) was 13 tons 13 cwt. Only slight traces of late blight were observed on the tubers when they were lifted, but reports from various districts indicate that *Great Scot* is rather susceptible to blight. It should, however, be pointed out that it usually matures early in September, and it should not be left in the ground until the middle of October.

The Ally.—This appears to be one of the most reliable of the immune varieties. The average yield per acre of the 7 stocks tested was 13 tons 12 cwt. Recent cooking tests have proved its quality to be quite good.

Arran Comrade.—Owing to weather conditions this variety cropped only moderately well.

The Abundance Group.—The majority of these varieties appeared to be rather susceptible to late blight, but produced good uniform crops although in a few cases there was a rather high percentage of 'chats.'

Tinwald Perfection (Farish) or Rob Roy.—The criticism of this variety in past trials has been that the tubers were small. This year it has yielded heavy crops of good sized tubers. The yields from the two stocks of Scotch "seed" were both at the rate of over 13 tons per acre.

Lochar.—Last year this variety was an absolute failure in the trials. This was due to the fact that the "seed" was "two years from Scotland," and a large amount of "leaf-curl" developed. This year Scotch "seed" was planted and it has cropped even better than when it was first tested in 1916. The average yield per acre of the 7 stocks

(including *Heather Bountiful*) was 13 tons. The crop showed a certain amount of second-growth.

Dominion.—The stock of this variety was purer than in previous years, but there was a small percentage of *Arran Chief* present. Second growth was very prevalent.

Rhoderic Dhu.—This variety has a very strong vigorous haulm and gave a fairly good crop of medium-sized tubers.

Clan Alpine.—The haulm was not vigorous and the tubers were very uneven in shape.

Snowball.—The stock of *Snowball* on Plot No. 85 was indistinguishable from *Schoolmaster*. The stocks on Plots Nos. 86 and 87 were not true to name, being chiefly of the *Abundance* type.

Leinster Wonder.—A very wild type with masses of fibrous roots and long stringy stolons (see Fig. 25). There was a good average crop of medium-sized tubers.

Templar.—This variety produced a large percentage of chats and seed-sized tubers.

Shamrock and Flourball.—Careful observations have made it evident that these varieties are quite similar. The chief feature of both is a high degree of resistance to "late blight." Messrs. Suttons state that *Flourball* was originally purchased by them in Ireland.

Kerr's Pink.—This variety was very vigorous, and again cropped well. A certain amount of second-growth was present.

Majestic.—The results from the stocks of this variety were very disappointing. The haulms were far from vigorous and the crop ripened prematurely. In the Board's trials in other districts, however, *Majestic* gave very heavy crops.

Nithsdale.—This variety gave an abnormally high percentage of chats. The number of tubers per root was quite good but owing to their small size the crop was only a very moderate one.

Langworthy and Golden Wonder.—The low yields of these varieties were due partly to the plots being quite near a row of trees.

NOTES ON NEW IMMUNE VARIETIES. *Witch Hill Seedling*.—This is a first early variety bearing a close resemblance to *Snowdrop*. In the trials of previous years it has been classed either as susceptible or as being of doubtful immunity. This was due to the fact that the stock was impure. Messrs. Dobbie & Co. kindly sent 1 cwt. for trial in 1918 in order that the test might be quite definite. All the tubers were cut and those which appeared untrue to type were discarded. When growing it was found that two "rogues" of *British Queen* were present. These were marked and removed. The remainder showed no trace of wart disease, and the variety has now been approved as immune.

Ashleaf (Sutton).—This first early differs from *Myatt's Ashleaf*, chiefly in foliage, but the tubers appear to be quite similar. Various types of *Ashleaf* will have to be grown next year in order to ascertain if there are any easily distinguishable characteristics.

Coronation.—A first early, white, round variety which is similar to a variety previously tested named *Crown Jewel* (Toogood).

Abundance Types.—The following varieties all appear to be of the *Abundance* Type and call for no further comment:—*Osborne Seedling*, *Waverley*, *Ballhayocks*, *Seedling 104 (Guthrie)*, *Tillycorthie Seedling*, *Peace Abundance*, *Seedling No. 21 (Minn)*, *Bloomfield*, *Laing's Prolific*.

Dargavel and an Unnamed Variety (No. 227) resemble *Flourball*.

Carraigie.—This is a late white kidney which appears to be in-

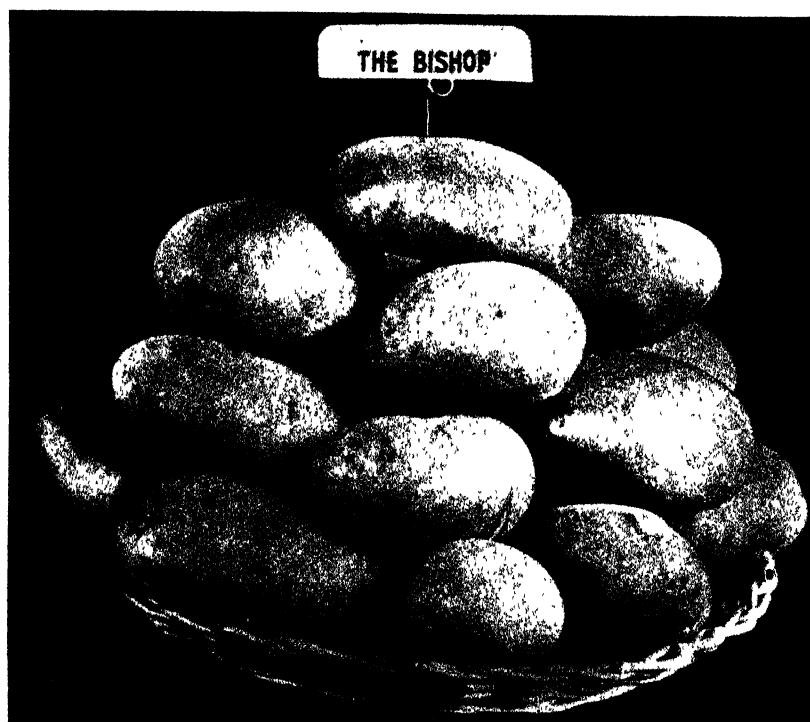


FIG. 32 — *The Bishop* (Wilson).



FIG. 33.-- *Scottish Farmer.*

distinguishable from *White City*. It was raised by Mr. Findlay several years ago.

Irish Strain.—In haulm and foliage this variety closely resembles *Irish Queen*. The tubers are round with rather deep eyes; the skin is white with a pink coloration around the eyes.

NEW VARIETIES WHICH HAVE PROVED IMMUNE.

No. of Plot.	Variety.	Description.	Name of Sender.	Yield per Acre.		
				Seed and Ware.	Chats.	Total.
142	Witch Hill Seedling.	W.K. Early ..	Dobbie & Co., Edinburgh.	T. c. 4 2	T. c. 1 5	T. c. 5 7
159	Ashleaf (Sutton) Snowdrop	W.K. " ..	Sutton & Sons, Reading	3 3	1 6	4 9
9	(Perkins).	W.K. " ..	Sutton & Sons, Reading	2 1	0 15	2 16
176	Snowdrop	W.K. " ..	J. L. Clucas, Ormskirk	2 8	0 15	3 3
177	Coronation (Perkins).	W.R. " ..	J. Gardiner, Perth ..	2 14	1 8	4 2
199	Seedling 84 R. (Gardiner).	W.R. 2nd Early	A. Findlay, Auchtermuchty.	6 18	1 8	8 6
147	Osborne Seedling (Gray).	W.O. Early Main Crop	Cross & Co., Wisbech	7 0	1 1	8 1
148	Waverley " (Nicholson).	W.O. " ..	Jas. Gray, Glasgow	8 3	0 7	8 10
156	Balthayrock " (Guthrie).	W.O. 2nd Early	Clark Bros., Carlisle ..	9 17	1 5	11 2
158	Balthayrock " (Guthrie).	W.O. " ..	Wm. Robertson, Perth	10 5	0 13	10 18
189	Seedling 104 (Guthrie)	W.O. " ..	Guthrie Bros., Fife ..	8 9	0 6	8 15
191	Tillycorbie Seedling.	W.O. Late ..	B. Reid, Aberdeen ..	8 9	0 16	9 5
233	Peace Abundance (Scarlett).	W.O. 2nd Early	T. A. Scarlett, Edinburgh.	8 8	0 4	8 12
289	Seedling No. 21 (Mills).	W.O. Early Main crop	T. E. Mills, Warrington.	9 12	0 16	10 6
298	Bloomfield " ..	W.O. " ..	J. McIntyre, Brechin ..	5 1	0 14	5 15
299	Laing's Prolific " ..	W.O. " ..	" ..	5 13	1 12	7 5
211	Seedling " ..	W.O. 2nd Early	Bees, Ltd., Liverpool ..	Only few tubers planted		
149	Irish Strain (Straun)	W.R. Late ..	Warden & Stewart, Belfast.	9 4	1 3	11 1
152	Bishop (Wilson)	W.K. Late ..	Guthrie Bros., Fife ..	9 18	1 3	11 1
282	" ..	W.K. " ..	Sumner & Leivesley, Ormskirk.	11 15	1 12	13 7
183	Anon. " ..	C.R. Early Main crop.	J. Gardiner, Perth ..	3 15	2 14	6 9
185	Linda " ..	W.O. Late ..	" ..	7 3	0 11	7 14
187	Seedling U15 (Mackelvie).	W.R. Late ..	E. Mackelvie, Lamlash	12 15	0 16	13 11
188	Seedling U67 (Mackelvie).	W.R. " ..	" ..	7 10	0 5	7 15
205	Paragon (Toogood)	W.R. " ..	Toogood & Sons, Southampton.	1 13	0 8	2 1
221	Irish Chieftain (McKeuna)	W.K. " ..	Wm. Hamilton, Castle Blaney.	11 0	0 15	11 15
227	Unnamed " ..	C.R. " ..	Sergt. Jones, Llanberis	8 19	0 15	9 14
285	Dargavel " ..	C.R. " ..	A. W. McAlister, Dumfries.	9 1	0 14	9 15
276	Seedling 449 A1 (Wilson).	W.R. " ..	Wotherspoon & Donald, Glasgow.	10 4	0 13	10 17
278	Seedling 142/6 ..	W.R. " ..	" ..	5 4	0 10	5 14
279	Seedling 472 D/6	W.R. " ..	" ..	5 4	1 3	6 7
193	Carnegie " ..	W.K. " ..	A. Findlay, Auchtermuchty.	8 18	0 9	9 7

Irish Chieftain.—This is a late white kidney, or, more strictly speaking, an elongated cylindrical tuber. In 1917 a potato was sent by Messrs. Barr & Sons under the name of *Irish Chieftain* which proved susceptible to wart disease. The tubers in this instance were round to oval with rather deep eyes.

Bishop (Wilson).—A late white kidney. The tubers, which are very handsome, resemble *White City* in many respects. It has cropped well and promises to be a good commercial variety.

Anon (No. 183).—A coloured potato which cropped only moderately and appears to be of no commercial value.

Linda.—The haulm bears a resemblance to *British Queen*, but the tubers are distinct from that variety.

Seedling U 15 (Mackelvie).—This is one of the most promising varieties tested in 1918. It is a white, round, late variety. On many tubers the eyes are rather deep at the rose end. It cropped well and should prove a good commercial variety.

U 67 (Mackelvie).—The tubers are round, large and rather coarse, with deep eyes. The haulm is strong.

84 R (Findlay).—An early maincrop variety, said by Mr. Findlay to be practically identical with the variety *Entente Cordiale*.

Paragon.—This variety was tested in 1916 and was then classed as being of doubtful immunity. This year the stock was carefully "rogued" and has proved immune. It is probably of no commercial value.

Seedling 449/A1 (Wilson).—A white, round, late variety. It has a vigorous medium haulm and white flowers.

Seedling 142/6 (Wilson).—A white, round, late variety; haulm erect to spreading; flowers white.

Seedling 472 D/6 (Wilson).—A white, oval, late variety. It cropped only moderately well.

DESCRIPTIVE AND CLASSIFIED LIST OF IMMUNE VARIETIES.

Early Varieties.

(a) WHITE ROUND SECTION.

1. *Sutton's A. 1*. Tubers.—Round, medium size; eyes rather deep; skin white; flesh yellow; sprouts purple. Foliage.—Haulm upright, becoming spreading; leaves dark green, small and crinkled. Flowers.—Seldom, if ever formed.
2. *Early Border*.—Similar to A. 1.
3. *Coronation* (Gardiner). Tubers.—Round, small; eyes shallow; skin white; flesh white; sprouts traces of purple at base. Foliage.—Haulm dwarf, spreading, leaves medium green, small and glossy. Flowers.—Not observed.
4. *Crown Jewel* (Toogood).—Similar to Coronation.
5. *America* (Dobbie). Tubers.—Round; eyes medium depth; flesh white; skin white; sprouts dark rose. Foliage.—Haulm medium, spreading. Flowers.—Heliotrope.

(b) WHITE KIDNEY SECTION.

6. *Resistant Snowdrop* (Dobbie). Tubers.—Kidney; eyes very shallow; skin white; flesh white; sprouts with traces of purple at base. Foliage.—Haulm spreading and moderately vigorous. Flowers.—Creamy white, seldom formed.
7. *Snowdrop* (Perkins).—Similar to Resistant Snowdrop. Pure stocks of the true white-fleshed Snowdrop are immune.
8. *Witch Hill Seedling* (Brown). Tubers.—Kidney; eyes very shallow; skin white; flesh white. Foliage.—Haulms spreading and moderately vigorous. Flowers.—Creamy white, seldom formed.

9. *Dargill Early* (Gardiner). Tubers.—Kidney; eyes shallow; skin white; flesh pale yellow; sprouts white. Foliage.—Haulm medium, upright to spreading; leaves medium green and crinkled. Flowers.—Heliotrope. Rarely flowers.
- (c) COLOURED ROUND OR OVAL SECTION.
10. *Arran Rose* (Mackelvie). Tubers.—Oval; skin pink; eyes shallow; flesh white; sprouts deep rose. Foliage.—Haulm medium, strong. Flowers.—Creamy white, rarely flowers. (Fig. 26.)
11. *Edzell Blue*. Tubers.—Round; eyes medium depth; skin reddish-purple; flesh pure white; sprouts deep purple. Foliage.—Haulm upright to spreading, vigorous. Flowers.—White. Not, strictly speaking, a *first* early.

Second Early Varieties.

(a) WHITE ROUND OR OVAL SECTION.

12. *King George* (Gardiner). Tubers.—Usually elongated, irregular in shape, eyes shallow; skin white; flesh white; sprouts white. Foliage.—Haulm spreading, fairly strong; leaves medium green. Flowers.—White.
13. *Great Scot* (McAlister). Tubers.—Round, large; eyes medium depth; skin white; flesh white; sprouts with traces of pink. Foliage.—Haulm tall, upright and vigorous, leaves dark green and glossy. Flowers.—White, buds usually drop without opening. This variety crops well and may be grown as an early maincrop.
14. *Sir Douglas Haig* (Sands).—Similar to Great Scot.
15. *Conqueror*.—Similar to Great Scot.
16. *Southampton Wonder* (Toogood).—Similar to Great Scot.
17. *The Ally* (Mackelvie). Tubers.—Oval to elongated, usually very flat; eyes shallow; skin white; flesh white; sprouts white. Foliage.—Haulms spreading and fairly vigorous; leaves greyish-green, glossy. Flowers.—White. (Fig. 27.)
18. *The Duchess* (Dobbie). Tubers.—Round; eyes medium depth; skin white, flesh white. Foliage.—Haulm spreading and moderately vigorous. Flowers.—White.
19. *Conquest* (Findlay). Tubers.—Round; eyes medium depth; skin white; flesh white. Foliage.—Haulm medium, spreading, leaves medium green, large. Flowers.—White.
20. *Snowball* (Carter). Tubers.—Round; skin white, flesh white. Foliage.—Haulm upright at first, becoming prone; leaves medium green, rather small. Flowers.—White.
21. *Schoolmaster*. Tubers.—Round; skin white; flesh white. Foliage.—Haulm upright at first, becoming prone; leaves medium green, rather small. Flowers.—White.
22. *Arran Comrade* (Mackelvie). Tubers.—Oval; eyes shallow; skin white; flesh white; sprouts purple. Foliage.—Haulm upright, slightly spreading. Flowers.—Cream. (Fig. 28.)
23. *Aberlady Early*. Tubers.—Round; eyes shallow; skin white; flesh white. Foliage.—Tall, upright, spreading; leaves dark green, glossy. Flowers.—Not observed.
- (b) COLOURED ROUND OR OVAL SECTION.
24. *The Dean*. Tubers.—Round; eyes shallow; skin purple; flesh white. Foliage.—Medium spreading; leaves dark green, crinkled. Flowers.—Not observed.

25. *Adirondack*. Tubers.—Round; eyes deep; skin pink; flesh white. Foliage.—Haulm medium, spreading. Flowers.—Not observed.
26. *The Towse, or Towser*. Tubers.—Round; eyes medium; skin pink; flesh white. Foliage.—Medium spreading, weak; leaves usually curled. Flowers.—Not observed.
27. *Climax*.—Similar to *The Towse*.
28. *Mauve Queen* (Dobbie). Tubers.—Round; eyes medium depth; skin mauve; flesh white. Foliage.—Haulm medium, upright, very vigorous; stalk purple; leaves dark green, large. Flowers.—Creamy white, large.

(c) COLOURED KIDNEY SECTION.

29. *Mr. Bresse*. Tubers.—Kidney, large; eyes very shallow; skin pink; flesh white with slight pink tinge. Foliage.—Haulm medium, spreading, weak; leaves yellowish-green, small, curled. Flowers.—White.
30. *Border Queen*.—Similar to *Mr. Bresse*, but skin of deeper colour.
31. *Crimson Beauty*.—A coloured kidney very similar to *Mr. Bresse*.
32. *Cardinal*. Tubers.—Kidney; eyes very shallow; skin dark red; flesh white. Foliage.—Haulm upright at first becoming prone; leaves dark green, crinkled. Flowers.—Mauve, tipped white.

Late Varieties.

(a) WHITE ROUND OR OVAL SECTION.

33. *Abundance*. Tubers.—Round to oval, flat; eyes shallow; skin white; flesh white, sprouts purple. Foliage.—Haulm strong, tall, upright; leaves darkish green, glossy. Flowers.—White.

An early maincrop variety rather liable to Late Blight. It usually crops well.

34. *Culdees Castle*.—Similar to *Abundance*.
35. *Admiral* (Dobbie).— „
36. *The Provost* (Dobbie).— „
37. *The Crofter* (Dobbie).— „
38. *Favourite* (Dobbie).— „
39. *Jeanie Deans*.— „
40. *Twentieth Century*.— „
41. *Priory Queen*.— „
42. *Secundus* (Dobbie).— „
43. *King Albert* (Sands).— „
44. *Osborne Seedling* (Gray).— „
45. *Waverley*.— „
46. *Scotch Pride*.— „
47. *Tillycorrhie Seedling*.— „
48. *Peace Abundance* (Scarlett). „
49. *Bloomfield*.— „
50. *Balthayocks*.— „
51. *Laing's Prolific*.— „
52. *Kerr's New White*.— „
53. *Burnhouse Beauty* (Dobbie).—This variety bears a close resemblance to the *Abundance* group, but its flowers are lavender and white.

54. *Tinwald Perfection* (Farish). Tubers.—Oval to elongated ; eyes shallow ; skin white ; flesh white, tinged lemon ; sprouts white. Foliage.—Haulm medium height, spreading, moderately vigorous ; leaves darkish green. Flowers.—Mauve, tipped white. (Fig. 29.)
55. *Rob Roy* (McAlister).—Similar to *Tinwald Perfection*.
56. *Dominion* (Poad). Tubers.—Round to oval, flat ; eyes shallow ; skin white ; flesh white. Foliage.—Haulm tall, vigorous, somewhat spreading ; leaves medium green with veins well marked. Flowers.—White.
57. *Rhoderic Dhu* (Farish, S. T.). Tubers.—Round to oval ; eyes medium depth ; skin white, flesh white. Foliage.—Haulm tall, upright, very vigorous ; leaves medium green, large. Flowers.—White.
58. *Clan Alpine* (Farish, S. T.). Tubers.—Oval, rather irregular in shape ; eyes medium depth ; skin white ; flesh white. Foliage.—Haulm medium, spreading, rather weak. Flowers.—White.
59. *The Laird* (Davie). Tubers.—Round, eyes shallow ; skin white ; flesh white. Foliage.—Medium spreading, vigorous haulm ; leaves medium green, crinkled. Flowers.—Not observed.
60. *Supreme* (Sutton). Tubers.—Oval, rather irregular in shape ; eyes medium depth ; skin white ; flesh white. Foliage.—Haulm medium spreading, fairly vigorous ; leaves dark green, small. Flowers.—Not observed.
61. *The Lochar* (Farish, W. R.). Tubers.—Round ; eyes medium depth ; skin white with faint tinge of pink, especially around the eyes ; flesh white ; sprouts white. Foliage.—Haulm upright, becoming spreading, moderately vigorous ; leaves characteristic delicate shade of green, rather small. Flowers.—White.
62. *Heather Bountiful*.—Similar to *The Lochar*.
63. *Leinster Wonder* (Williamson). Tubers.—Round, flat ; skin white ; sometimes showing a faint tinge of pink ; flesh white ; sprouts rose coloured. Foliage.—Haulm tall, upright, vigorous ; leaves dark green. Flowers.—White, borne on long stalks.
64. *Templar* (Wilson). Tubers.—Oval, flat, medium size ; eyes fairly shallow ; skin white ; flesh white ; sprouts purple. Foliage.—Haulm upright, tall, very vigorous ; leaves dark green. Flowers.—White, borne on long stalks. The variety flowers freely.
65. *Champion*. Tubers.—Round ; eyes very deep ; skin white ; flesh yellow ; sprouts purple. Foliage.—Haulm tall, upright ; stem purple colour ; leaves dark green, small. Flowers.—Deep mauve, tipped white.
66. *Paragon*. Tubers.—Round, small ; eyes shallow ; skin white ; flesh white. Foliage.—Dwarf, upright ; leaves medium green. Flowers.—Not observed.

(b) COLOURED ROUND SECTION.

67. *Kerr's Pink*. Tubers.—Round ; eyes usually medium depth but occasionally deeper ; skin light pink ; flesh white ; quality excellent. Foliage.—Haulm strong, tall, upright ; leaves medium green, fairly large. Flowers.—White, blooms freely. (Fig. 30.)

68. *Rector* (Wilson). Tubers.—Round ; eyes fairly deep ; skin red ; flesh white, tinged lemon ; quality excellent. Foliage.—Haulm tall, upright, vigorous ; leaves dark green, slightly crinkled, with dull surface. Flowers.—Rose-purple, tipped white, blooms freely.
69. *Irish Queen* (Strain). Tubers.—Round, usually 4 or 5 large tubers per root ; eyes deep ; skin pink ; flesh white. Foliage.—Haulm tall, becoming spreading later ; leaves dark green. Flowers.—Purple.
70. *Irish Strain* (Strain). Tubers.—Round ; eyes very deep ; skin white with patches of pink, especially at the eyes ; flesh white ; Foliage.—Haulm tall, erect ; leaves yellowish green, glossy, flat. Flowers.—Mauve, tipped white.
71. *Shamrock*. Tubers.—Round, rather irregular in shape ; eyes deep ; skin reddish-pink ; flesh white. Foliage.—Haulm tall, becoming spreading later ; leaves dark green. Flowers.—White, usually numerous.
72. *Flourball* (Sutton). Tubers.—Round, rather irregular in shape ; eyes deep ; skin reddish-pink ; flesh white. Foliage.—Haulm tall, becoming spreading later ; leaves dark green. Flowers.—White, usually numerous.
73. *Dargavel*.—Similar to Flourball.
74. *King of the Russels* (Carter). Tubers.—Round ; eyes deep ; skin dark pink ; flesh white. Foliage.—Haulm medium spreading ; leaves dark green, small. Flowers.—White.
75. *Arran Victory* (Mackelvie). Tubers.—Round ; eyes medium ; skin purple ; flesh white. Foliage.—Haulm upright, tall, strong, with reddish colour ; leaves dark green. Flowers.—Cream.

(c) WHITE KIDNEY SECTION.

76. *Langworthy* (Niven). Tubers.—Kidney, often tapering at "heel" ; eyes shallow ; skin white ; flesh white ; sprouts purple. Foliage.—Haulm tall, vigorous, upright ; leaves slightly crinkled. Flowers.—Mauve, tipped white.
77. *What's Wanted*.—Similar to Langworthy.
78. *Golden Wonder* (Brown). Tubers.—Kidney, often tapering at "heel" ; eyes shallow ; skin characteristic yellowish, russety-brown tinge ; flesh white ; sprouts purple. Foliage.—Similar to Langworthy. Flowers.—Ditto.
79. *White City* (Sutton). Tubers.—Kidney, large ; eyes very shallow ; skin white, russet ; flesh white ; quality good. Foliage.—Haulm tall, vigorous, upright, usually with three or four strong branches ; leaves darkish-green with well-marked veins. Flowers.—Lilac, tipped a lighter shade.
80. *Carnegie* (Findlay).—Similar to White City.
81. *Goldseeker*.—Similar to White City.
82. *Table King*.—Similar to White City.
83. *St. Malo Kidney*. Tubers.—Kidney, large, sometimes irregular in shape ; eyes shallow ; skin white ; flesh white. Foliage.—Haulm tall, upright, vigorous ; leaves dark green. Flowers.—Not observed.
84. *Majestic* (Findlay). Tubers.—Kidney, somewhat irregular ; eyes shallow ; skin white ; flesh white ; quality excellent ; sprouts.

- white. Foliage.—Haulm medium height, spreading, only moderately vigorous; leaves medium green. Flowers.—White. (Fig. 31.)
85. *Nithsdale* (McAlister). Tubers.—Kidney, often tapering at "heel," small; eyes shallow; skin white; flesh white. Foliage.—Haulm medium, spreading; leaves medium green, large. Flowers.—White.
86. *Bishop* (Wilson). Tubers.—Kidney; eyes shallow; skin white; flesh white. Foliage.—Haulm medium, slightly spreading. Flowers.—Rose-purple. (Fig. 32.)
87. *Irish Chieftain* (McKenna).—Tubers.—Long cylindrical; eyes moderately deep; skin white; flesh white; sprouts bright purple. Foliage.—Haulm tall, erect, leaves small, grey-green colour. Flowers.—Mauve, tipped white.

COMPLETE LIST OF VARIETIES TESTED.

Immune Varieties.

Name.	Description.		Season.
	Tubers.	Flowers.	
A. 1 (Sutton) ..	W.R.	White ..	Early.
Aberlady Early ..	W.R.	White ..	2nd Early.
Abundance (Sutton) ..	W.O.	White ..	Early Maincrop.
Adirondack ..	C.R.	— ..	2nd Early.
Admiral (Dobbie) ..	Abundance Type ..		—
Ally (Mackelvie) ..	W.O.	White ..	2nd Early.
America (Dobbie) ..	W.R.	Heliotrope ..	Early.
Anon ..	C.R.	White ..	Early Maincrop.
Arran Rose (Mackelvie)	C.O.	White ..	Early.
Arran Comrade ..	W.O.	Cream ..	2nd Early.
(Mackelvie).			
Arran Victory ..	C.R.	Cream ..	Late.
(Mackelvie).			
Ashleaf (Sutton) ..	W.K.	Pale Lilac ..	Early.
Balthayocks ..	Abundance Type ..		—
Bishop (Wilson) ..	W.K.	Rose-purple ..	Late.
Bloomfield ..	Abundance Type ..		—
Border Queen ..	C.K.	— ..	2nd Early.
Burnhouse Beauty ..	W.O.	Lavender ..	Early Maincrop.
(Dobbie).			
Cardinal ..	C.K.	Mauve ..	2nd Early.
Carnegie (Findlay) ..	White	City Type ..	—
Champion ..	W.R.	Mauve ..	Late.
Clan Alpine (S. T. Farish)	W.O.	White ..	Late.
Climax ..	Syn :	The Towse ..	—
Conqueror ..	Great Scot Type ..		—
Conquest ..	W.R.	White ..	2nd Early.
Coronation Kidney ..	W.K.	— ..	Early.
Coronation (Gardiner) ..	W.K.	— ..	Early.
Crimson Beauty ..	C.K.	— ..	2nd Early.
Crown Jewel (Toogood) ..	Syn :	Coronation (Gardiner).	

Name.	Description.		Season.
	Tubers.	Flowers.	
Culdees Castle	Abundance Type	..	—
Dargavel	Flourball Type	..	—
Dargill Early (Gardiner)	W.K. Heliotrope	..	Early.
Dean	C.R. —	..	2nd Early.
Dominion (Poad)	W.O. White	..	Late.
Duchess (Dobbie)	W.R. White	..	2nd Early.
Early Border (Ray)	Syn : A 1. (Sutton).	..	—
Edzell Blue	C.R. White	..	Early.
Favourite (Dobbie)	Abundance Type	..	—
Flourball (Sutton)	C.R. White	..	Late.
Five Mile Town (Carter)	W.R. White	..	Late.
Garton's No. 17	W.R. —	..	2nd Early.
Garton No. 22	W.R. —	..	Late.
Garton's No. 32	W.R. —	..	Late.
Gell's Seedling	Snowdrop Type	..	—
Golden Wonder (Brown)	W.K. Mauve	..	Late.
Goldsecker (Erricks) ..	White City Type	..	—
Great Scot (McAlister) ..	W.R. White	..	2nd Early.
Heather Bountiful	Syn : Lochar.	..	—
Irish Chieftain	W.K. Mauve	..	Late.
(McKenna).			
Irish Queen (Strain)	C.R. Purple	..	Late.
Irish Strain (Strain)	W.R. Purple	..	Late.
Jeanie Deans	Abundance Type	..	—
Kerr's New White	Abundance Type	..	—
Kerr's Pink (Dobbie)	C.R. White	..	Late.
King Albert (Sands)	Abundance Type	..	—
King George (Gardiner)	W.O. White	..	2nd Early.
King of the Russets	C.R. White	..	Late.
(Carter).			
Laird	W.R. —	..	Late.
Laing's Prolific	Abundance Type	..	—
Langworthy (Niven)	W.K. Mauve	..	Late.
Leinster Wonder	W.R. White	..	Late.
(Williamson).			
Lochar (Farish)	W.R. White	..	Late.
Majestic (Findlay)	W.K. White	..	Early Maincrop.
Mauve Queen (Dobbie)	C.R. White	..	2nd Early.
Mr. Bresse	C.R. —	..	2nd Early.
Nithsdale (McAlister)	W.K. White	..	Early Maincrop.
Osborne Seedling (Gray)	Abundance Type	..	—
Paragon (Toogood)	W.R. —	..	2nd Early.
Peace Abundance	Abundance Type	..	—
(Scarlett).			
Pink Seedling (Sharp)	C.R. Lavender	..	Late.
Pott's Profit	W.K. —	..	Early.
Priory Queen (Dobbie)	Abundance Type	..	—
Provost (Dobbie)	Abundance Type	..	—
Rector (Wilson)	C.R. Rose-purple	..	Late.
Resistant Snowdrop	W.K. White	..	Early.
(Dobbie).			
Rhoderic Dhu	W.R. White	..	Late.
(S. T. Farish).			
Rob Roy (McAlister)	Syn : Tinwald Perfection.	..	—
Secundus (Dobbie)	Abundance Type	..	—
Schoolmaster	W.R. White	..	2nd Early.
Scotch Pride	Abundance Type	..	—
Seedling 104 (Guthrie) ..	Abundance Type	..	—
Seedling 84/R (Findlay)	W.R. —	..	Early Maincrop.

Name.	Description		Season.
	Tubers.	Flowers.	
Seedling 449/A 1 (Wilson).	W.R.	White	Late.
Seedling 142/2 (Wilson).	W.R.	White	Late.
Seedling 472/D 6 (Wilson).	W.O.	—	Late.
Seedling No. 21 (Miln) ..	Abundance Type.	—	—
Seedling (Mee) ..	W.R.	—	Late.
Shamrock ..	C.R.	White	Late.
Sir Douglas Haig (Sands)	Great Scot Type.	—	—
Snowball (Carter) ..	W.R.	White	2nd Early.
Snowdrop (Perkins) ..	W.K.	White	Early.
St. Malo Kidney ..	W.K.	—	Late
Southampton Wonder (Toogood).	Great Scot Type.	—	—
Supreme (Sutton) ..	W.O.	—	Late.
Table King (Webb) ..	White City Type.	—	—
Tillicorthie Seedling (Reid).	Abundance Type.	—	—
Templar (Wilson) ..	W.R.	White	Late.
Tinwald Perfection (Farish)	W.O.	Mauve	Late.
Towser ..	Syn.	The Towse.	—
The Towse ..	C.R.	—	2nd Early
Twentieth Century ..	Abundance Type.	—	—
What's Wanted ..	Langworthy Type.	—	—
White City (Sutton) ..	W.K.	Lilac	Late
White Lady ..	Abundance Type.	—	—
Witch Hill (Brown) ..	W.K.	White	Early
Waverley (Nicholson) ..	Abundance Type.	—	—

Susceptible Varieties.

Name	Description.		Season.
	Tubers.	Flowers.	
Advancer (Carter) ..	W.K.	—	Late.
Aeroplanes ..	Northern Star Type	—	—
Ajax (Jack) ..	W.R.	—	Late.
Alpha Early ..	W.R.	—	Early.
Arran Beauty (Mackelvie).	W.O.	White	2nd Early.
Arran Mascot (Mackelvie).	W.K.	White	Early.
Allies ..	Northern Star Type.	—	—
Alfred A. Lamont (Houliston).	Up-to-Date Type.	—	—
Ashleaf (Myatt) ..	W.K.	Pale Lilac	Early.
Avon Queen (Poad) ..	—	White	Early.
Arran Chief (Mackelvie).	W.R.	White	Late.
Autocrat (Miln) ..	Up-to-Date Type.	—	—
Balmoral Castle (Sutton).	W.R.	Lilac	Late.

Name.	Description.		Season.
	Tubers.	Flowers.	
Barry	Up-to-Date Type.	—	—
Bantam	W.R. Lavender ..	Late.	—
Barshell No. 9	W.K. White ..	Late.	—
Barshell No. 10	W.O. White ..	Late.	—
Beauty of Hebron	W.O. White ..	2nd Early.	—
Bell's Seedling	W.K. —	Early.	—
Beachus Early Giant	British Queen Type.	—	—
Berwick Castle	W.O. —	2nd Early.	—
(Sutton).			
Black Watch	W.R. White ..	Late.	—
Bobby Burns (Farish)	W.R. Mauve ..	Late.	—
Bootle Gem (Grice)	British Queen Type.	—	—
Braemar Castle (Sutton)	W.R. Pale Lilac ..	Late.	—
British Queen	W.O. White ..	2nd Early.	—
Brown's Purple	C.R. —	Late.	—
Blue Peter	C.R. —	Late.	—
Bummy No. 1	W.R. White ..	Late.	—
Carisbrooke Castle	W.K. Pale Lilac ..	Early.	—
(Sutton).			
Centenary (Sutton)	W.R. White ..	Late.	—
Cetewayo	C.K. Mauve ..	2nd Early.	—
Champion Pink (Farish)	C.R. White ..	Late.	—
Chapman (Dobbie)	Up-to-Date Type.	—	—
Chelmsford No. 1	W.O. —	Late.	—
(Dobbie).			
Cigarette (Kerr)	W.R. Lilac ..	2nd Early.	—
Colleen (Williamson)	British Queen Type.	—	—
Colonist (Webb)	W.R. Heliotrope ..	Early.	—
Coral Red Kidney	C.K. White ..	Early.	—
(Toogood).			
Craigie Early	W.R. —	Early.	—
Cropwell (Poad)	W.O. —	Early Main Crop.	—
Crown	W.R. —	Late.	—
Cumberland Ideal	W.R. White ..	Late.	—
(Thomson).			
Champion Successor	W.R. Mauve ..	Late.	—
Controller (Drummond)	W.R. White ..	Late.	—
Cloverley (Stewart)	Sharpe's Express Type.	—	—
Comley's Seedling	Sharpe's Express Type.	—	—
Canadian	Up-to-Date Type.	—	—
Collodon	C.K. —	Late.	—
Canadian Snow	C.O. —	Late.	—
Dalhousie Seedling	Up-to-Date Type.	—	—
Dalmeny Early Queen	W.O. —	Early.	—
Dalmeny Perfection	Up-to-Date Type.	—	—
Dalmeny Regent	Up-to-Date Type.	—	—
Dr. Kitchen (Toogood)	W.O. —	2nd Early.	—
Duke of York	W.K. White ..	Early.	—
Dunnottar Castle	W.O. Pale Lilac ..	Early.	—
(Sutton).			
Drummond Castle	W.K. Lilac tipped,	Late.	—
(Sutton).	white.		
Dover Castle (Sutton)	W.K. White ..	Late.	—
Dargill Gem (Gardiner)	W.O. —	Early.	—
Dargill Kidney	W.K. Heliotrope ..	Early Main Crop.	—
(Gardiner).			
Drumwhindle (Gavin)	Up-to-Date Type.	—	—
Duchess of Buccleuch	Up-to-Date Type.	—	—
Early Bird (Toogood)	W.K. —	Early.	—

Name.	Description.		Season.
	Tubers.	Flowers.	
Early Favourite (Carter).	W.R.	—	Early.
Early Victory	W.K.	—	Early.
Ebor (Poad)	W.O.	—	2nd Early.
Eclipse	Sir John Llewellyn Type.		
Edgecote Purple	C.K.	—	2nd Early.
Eightyfold (Findlay) ..	C.R.	Pale Blue ..	2nd Early.
Emperor (Carter)	C.K.	—	Late.
Epicure (Sutton)	W.R.	White ..	Early.
Excelsior (Carter)	W.R.	—	Late.
Exhibition Red Kidney (Dobbie).	C.K.	—	Early.
Express (Webb)	Sharpe's Express Type.		—
Edinburgh Castle (Sutton).	W.K.	White ..	2nd Early.
Emperor	W.R.	White ..	Late.
Earliest Challenger (Houliston).	Epicure Type.		—
E. M. Seedling (Sharp)	W.K.	—	Late.
Early Pink Kidney (Napier).	C.K.	White ..	Early.
Early Riser	W.O.	—	Early.
Ewnie Red (Jack)	C.R.	—	Late.
Early Regent (Sutton)	W.R.	Mauve ..	2nd Early.
Ensign Bagley	W.O.	—	Early.
Factor (Dobbie)	Up-to Date Type.		—
First Crop (Webb)	W.R.	—	Early.
Flounder	W.R.	Mauve ..	2nd Early.
Faithlie (Reid)	Duke of York Type.		—
Future Fame	W.O.	—	Early Main Crop.
Fife's Blue (Laing)	C.K.	—	Early.
Gardiner's No. 2	W.R.	—	—
Gardiner's No. 3	W.R.	—	—
General (Thomson)	W.R.	White ..	Late.
General Joffre (Sands) ..	C.R.	Heliotrope ..	Early.
Gladiator	W.K.	Pale Lilac ..	Late.
Glamis Beauty (Jack) ..	Up-to-Date Type.		—
Goldfinder (Carter)	W.O.	—	Late.
Gordon Castle (Sutton)	W.O.	Pale Lilac ..	Late.
Golden City (T. Wilson)	President Type.		—
Harbinger (Sutton)	W.K.	Nonflowering	Early.
Herd Laddie (Kerr)	C.R.	—	2nd Early.
Harlech Castle (Sutton)	W.K.	Lilac tipped White.	Late.
Hibernia (Findlay)	C.K.	—	Late.
Imperator	W.R.	Lilac ..	Late.
Irish Hero (Sands)	W.R.	—	Late.
Iron Duke (Brown)	President Type.		—
Ivanhoe (Toogood)	C.K.	—	2nd Early.
Invincible	W.R.	Mauve ..	Late.
Irish King (Wheatley) ..	Up-to-Date Type.		—
Industrie	W.R.	—	Early
Irish Chieftain (Barr & Son).	W.R.	Mauve ..	Late.
Jolly Roger (Toogood) ..	W.K.	—	2nd Early.
J.W.V. 100 (Dobbie)	W.R.	—	—
Julian (Farish)	President Type.		—
Jones' Cropper (English)	Up-to-Date Type.		—
King Edward	C.K.	Mauve ..	Late.
Kerr's Early	British Queen Type.		—

Name.	Description.		Season.
	Tubers.	Flowers.	
Kerr's Seedling ..	Up-to-Date Type.	—	—
Leda ..	C.K.	—	2nd Early.
Liberty (Dixon) ..	W.O.	—	Late.
Lincluden ..	W.K.	—	Late.
Longkeeper (Carter) ..	Up-to-Date Type.	—	—
Lord Ancaster ..	W.K. Purple	..	Late.
(Gardiner).			
Linda ..	W.R. White	..	2nd Early.
Langholme Model ..	W.K. Faint Lilac	..	Early Main Crop.
(Findlay).			
Lord Tullibardine ..	W.O.	—	Late.
Lord Dufferin ..	Up-to-Date Type.	—	—
May Queen ..	W.K. Mauve	..	Early.
Meins Early Round ..	W.R.	—	2nd Early.
Midlothian Early ..	Duke of York Type.	—	—
Mighty Atom (Webb) ..	W.O. White	..	Late.
McPherson's Early ..	British Queen Type.	—	—
Maid of Auchterarder ..	British Queen Type.	—	—
Mouswald (Farish) ..	W.R. Purple	..	Late.
Magnificent (Findlay) ..	W.O.	—	Late.
Mainstay (Carter) ..	W.O. White	..	Late.
Midsummer Early ..	W.R. White	..	Early.
(Dobbie).			
New Guardian (Webb) ..	W.O.	—	2nd Early.
Ninetyfold (Sutton) ..	W.K.	—	Early.
Northern Star (Findlay) ..	W.R.	—	Late.
Norwich Wonder ..	W.O.	—	Early Main Crop.
(Daniels).			
Napier (Napier) ..	W.R. White	..	2nd Early.
Nova Scotians ..	Up-to-Date Type.	—	—
Peerless Rose (Ashley) ..	Coloured King Edward	—	—
Pink Eyes ..	C.K.	—	2nd Early.
President ..	W.R. Heliotrope	..	Late.
Prolific (Dobbie) ..	Up-to-Date Type.	—	—
Prosperity (Webb) ..	W.O.	—	Late.
Prosperity (Webb) ..	Up-to-Date Type.	—	—
Prosperity (Webb) ..	Arran Chief Type.	—	—
Princess May ..	W.K. White	..	Early Main Crop.
(Drummond).			
Pink Early ..	C.K.	—	Early.
Potato 316 (Poad) ..	W.K. Purple	..	Late.
Princess Royal (Whyte) ..	C.R. Blue	..	2nd Early.
Queen Mary ..	Royal Kidney Type.	—	—
Queen of the Veldt ..	C.O.	—	2nd Early.
Raynes Park White ..	British Queen Type.	—	—
(Carter).			
Reading Russet ..	C.R.	—	2nd Early.
Red Kidney (Scarlett) ..	C.K. White	..	Early.
Red Prince ..	C.O.	—	Late.
Red Seedling ..	C.O.	—	2nd Early.
Red Skin ..	C.K.	—	Late.
Riley's Early ..	W.O.	—	Early.
Ringleader (Sutton) ..	W.K. Pale Lilac	..	Early.
Royalty ..	British Queen Type.	—	—
Royal Kidney ..	W.K.	—	2nd Early.
Royal Salute (Poad) ..	W.O.	—	Early Main Crop.
Royal Standard ..	W.O.	—	Early.
(Toogood)			
Rent Payer (Nicholson)	Up-to-Date Type.	—	—

Name.	Description.		Season.
	Tubers.	Flowers.	
Reliance (Sutton) ..	W.K.	White ..	Late.
Ruby Queen ..	C.R.	—	Early.
Robson (Gavin) ..	British	Queen Type.	—
Robbie Burns (Drummond).	W.R.	White ..	2nd Early.
Satisfaction (Sutton) ..	W.O.	—	Late
*Scottish Farmer ..	President Type.	—	—
Scottish Standard ..	W.O.	—	2nd Early.
Seedling (Clucas) ..	Great Scot Type	..	—
Seedling (Rosbotham) ..	W.K.	—	Early.
Seedling (Rosbotham) ..	W.O.	White ..	2nd Early
Seedling No. 1 (McAlister).	W.O.	—	2nd Early
Seedling No. 2 (Dixon) ..	W.O.	—	Early.
Seedling No. 2 (Farish) ..	W.O.	White ..	2nd Early.
Seedling No. 3 (Farish) ..	W.O.	Mauve ..	Late.
Seedling No. 7 (McAlister).	W.R.	White ..	2nd Early.
Seedling S ₁ (Whitehead)	W.R.	White ..	Late.
Seedling S ₂ (Whitchad)	W.R.	White ..	Late.
Seedling S ₃ (Whitehead)	W.K.	Mauve ..	Late.
Seedling 85/R (Findlay) ..	W.O.	—	Late.
Seedling 86/R (Findlay) ..	W.K.	White ..	Late.
Seedling No. 16 (Farish) ..	W.K.	Light Purple ..	Late.
Seedling No. 4 (Wainwright) ..	Northern Star Type.	—	—
Seedling No. 6 (Wainwright)	W.O.	—	Late.
Seedling No. 8 (Wainwright)	Up-to-Date Type.	—	—
Seedling No. 3 M.T. ..	W.O.	White ..	Late.
Seedling D ₁ (Jack) ..	W.R.	White ..	Late.
Seedling D ₂ (Jack) ..	W.O.	White ..	2nd Early.
Seedling 16 M ₁ (Dobbie).	W.O.	Mauve ..	Late.
Seedling M.C. N.T. (Mills)	W.O.	—	Early.
Seedling 472/C. 2 (Wilson).	W.R.	—	Late.
Seedling No. 9 (Wilson) ..	Up-to-Date Type.	—	—
Seedling No. 5 (Miln) ..	W.O.	—	Early Main Crop.
Seedling No. 20 (Miln) ..	Mixed Stock ..	..	Mixed Stock.
Seedling No. 10 M.T. (Dobbie).	W.K.	—	2nd Early.
Seedling No. 22 M.T. (Dobbie).	W.R.	—	2nd Early.
Seedling 75 (Guthrie) ..	W.O.	—	Early.
Seedling E. 2 (Sands) ..	W.O.	White ..	Early.
Sharpe's Express ..	W.K.	Heliotype. ..	Early.
Sharpe's Victor ..	W.K.	Pale Blue ..	Early.
Sir Edward Carson (Sands).	W.R.	White ..	2nd Early.
Sir John Llewellyn ..	W.K.	White ..	Early.
Skerries ..	C.R.	—	Late.
Stirling Castle (Sutton) ..	W.R.	Pale Lilac ..	Late.
Stourbridge Glory (Webb).	W.K.	Mauve ..	Late.

* See Fig. 33.

Name.	Description.		Season.
	Tubers.	Flowers.	
St. Giles (Dobbie) ..	W.R.	—	—
Summit	W.O.	—	Late.
Student (Wilson) ..	Up-to-Date Type.	—	—
Stephenie 1	W.R. White	..	Late.
Stephenie 2	W.R. Heliotrope	..	Late.
Signet	Coloured King Edward	—	—
Table King	British Queen Type.	—	—
Table Talk (Niven) ..	Up-to-Date Type.	—	—
Tremendous (Toogood)	Up-to-Date Type.	—	—
Tribute (Toogood) ..	W.O.	—	Late.
Thuringen (Dobbie) ..	W.R.	—	Late.
Triumph (Toogood) ..	W.K.	—	Late.
The Scot (Summerville)	W.O. White	..	2nd Early.
The Tank (Farish) ..	President Type.	—	—
Unnamed (Oldham) ..	W.K.	—	2nd Early.
Unnamed (Rimmer) ..	—	—	—
Unnamed (Alcock) ..	Abundance Type.	—	—
Unnamed (Travis) ..	C.R.	—	2nd Early.
Unnamed (Dunton) ..	W.R. Mauve	..	Late.
Unnamed (Catterall) ..	Coloured King Edward	—	—
Unnamed (Malcolm) ..	—	—	—
Up-to-Date	W.O. Heliotrope	—	Late.
Victor (Toogood) ..	—	—	—
Vitality	W.O.	—	2nd Early.
Verdun	Sharpe's Express Type	—	—
Warwick Castle (Sutton)	W.R. Pale Lilac	..	Late.
White Ensign (Toogood)	W.K. Heliotrope	..	Early.
Wilson's Red Kidney (Dobbie).	C.K. White	..	2nd Early.
Windsor Castle (Sutton)	W.R. Lilac ..	..	2nd Early.
Yielder (Gardiner) ..	W.K. Deep purple	—	Late.

Varieties of Doubtful Immunity.

Name.	Description.		Season.
	Tubers.	Flowers.	
Banff Favourite ..	C.R.	Purple	Late.
Congo	C.K.	White	2nd Early.
Early Market (Sutton)	W.R.	—	2nd Early.
Ideal	W.K.	—	2nd Early.
Isis (Dobbie)	W.R.	White	Late.
Punta Arenas (Dobbie)	W.O.	White	Late.
Seedling No. 5 (Farish)	W.O.	—	Late.
Seedling No. 6 (Oxley) ..	W.K.	—	2nd Early.
St. Cuthbert (Dobbie) ..	W.K.	Mauve	—
Success (Toogood) ..	W.R.	—	Late.
Seedling M.C.G. 203 ..	—	White	—
Seedling M.C.G. 101 ..	—	—	—
Unnamed (Barr) ..	W.R.	—	—
Winton Abundance (Ashcroft).	W.R.	White	Early Maincrop.
W.T.W. (Dobbie) ..	W.O.	White	—

POTATOES: LOCAL IMMUNE VARIETY TRIALS.

Report for Season 1918.

JOHN SNELL, M.B.E., B.Sc.,

District Inspector, Board of Agriculture.

THE main purposes of the Ormskirk trials are to test varieties as to their immunity from wart disease, to obtain a correct description of the variety and thus to discover when the same variety appears under different names, and at the same time to obtain a general idea of the cropping powers and quality of the varieties. The Ormskirk Trials cannot, however, furnish information as to the suitability of the varieties for other districts in England and Wales. In order to obtain reliable information on this point it was decided to carry out a series of trials in those parts of the country where the spread of wart disease has become a serious menace to the potato crop.

DISTRICTS.—Thirty-six districts were selected and the trials were divided into two classes:—

1. Large trials of 1 stone of each of 21 immune varieties of potatoes.
2. Smaller trials of 3½ lb. of each of 12 varieties.

LARGE TRIALS.

District.	Position of Plot.	Description of Soil.	Crop in 1917.
Birmingham ..	Handsworth Park ..	Sandy loam	Potatoes.
Flint	Allotment at Buckley	Heavy loam	—
Cardiff	Roath Park	Heavy loam	Flowers and vegetables.
Nottingham ..	Arnold	Loam ..	—
Pwllheli	Church Field	Sandy loam	Brassicæ.
Hamsterley	—	Loam ..	Potatoes.
Colliery, Durham.			

PREPARATION OF PLOTS.—Unless otherwise stated, the land was bastard trenched. It was hoped that the preparation of the plots would have been carried out on a uniform plan at all the centres, but circumstances prevented this; at Pontardawe, Neath and Hamsterley the land was ploughed, at Abercynon it was ploughed and dug, while at Nuneaton it was dug one spit deep only.

SMALL TRIALS.

District.	Position of Plot.	Description of Soil.	Previous Crop.
Carlisle ..	Trinity Allotments ..	Sandy loam	Vegetables.
Blackburn ..	Allotment S.W. of Town	Sandy loam	Meadow land.
St. Helens ..	Pilkington Allotment, Ruskin Drive.	Medium loam.	—
Stockport ..	Alexandra Park.. ..	Sandy loam	Newly broken land.
Birkenhead ..	Forest Rd. Allotments	Loam ..	Potatoes.
Leeds ..	Roundhay, Leeds ..	Loam ..	Not cropped.
Huddersfield ..	Hollin Carr Allotment	Heavy loam	Potatoes and Brassica.
Sheffield ..	Hillsboro' Park ..	Sandy loam	No previous potato crop.
Buxton ..	Bowstones Lane, Fairfield.	Heavy loam	General, including potatoes
Walsall ..	The Arboretum ..	Stiff loam	Newly broken turf 1917.
Stafford ..	Stafford Freeman Allotments.	Sandy loam	Potatoes.
Market Drayton	Poor Law Institution	Sandy loam	Various garden vegetables.
Mansfield ..	King Edward Avenue Allotments.	Sandy loam	Carrots and onions.
Hugglescote ..	Private garden at Coalville	Sandy loam	Old pasture.
Bridgend ..	Cowbridge Road	Heavy loam, clay sub-soil.	—
Bishopston ..	Market garden at Bishopston.	Gravelly loam	Grass previous to 1917.
Abercynon ..	Parknewydd Farm ..	Medium loam.	Cabbages.
Pontardawe ..	Tyn-y-Pant Farm ..	Sandy alluvial loam.	Potatoes.
Kidderminster	Private Allotment ..	Light loam	Oats.
Nuneaton ..	Allotments	Very light, sandy loam	Potatoes poor crop
Wolverhampton	West Park ..	Light loam	Mixed crop.
Burton-on Trent	Outwood Recreation Ground	Medium loam	—
		Sandy loam	Potatoes

MANURES.—Those carrying out the trials were asked to apply farmyard manure at the rate of 12 tons per acre. Artificial manures were applied at the following rates :—

Superphosphate	4 cwt per acre.
Sulphate of Ammonia	1 " "
Sulphate of Potash.. .. .	1 " "

The suggestions were not strictly carried out in all cases, and the following exceptions must be noted :—

Pontardawe—800 lb. per half acre of " Rito " was applied.

Bishopston—20 tons of farmyard manure.

Mansfield—No farmyard manure was used.

Leeds—20 tons per acre of farmyard manure.

Birkenhead—24 tons of farmyard manure.

Nuneaton—No farmyard manure used, but 2 cwt. of Wakeley Hop Manure was dug in at time of planting.

PLANTING.—The potatoes were planted at distances of 30 in. between the drills and 15 in. between the sets. In order that tall, vigorous varieties might not interfere with the growth of the weaker varieties on adjoining plots, a space, the width of two drills, was left between each variety. At the majority of centres these intervening spaces were planted with Brown Dutch Dwarf Beans.

WEATHER CONDITIONS.—The weather conditions during the season were unfavourable. The early part of the season was dry, with the result that many of the early and second early varieties ripened prematurely. From the middle of August until the potatoes were lifted, there was practically continuous rain at all centres. This, in many varieties, caused a large amount of second growth and certainly affected the keeping qualities of the potatoes.

VARIETIES TESTED ON LARGE PLOTS.

Earlies.—*Edzell Blue* and *Witch Hill*.

2nd Earlies.—*King George*, *Great Scot*, *Ally* and *Mr. Bresse*.

Early Maincrops and Lates.—*Culdees Castle*, *Provost*, *Rob Roy*, *Lochar*, *Templar*, *Dominion*, *Tinwald Perfection*, *Kerr's Pink*, *Rector*, *Irish Queen*, *Shamrock*, *Langworthy*, *Golden Wonder*, *White City* and *Majestic*.

VARIETIES TESTED ON SMALL PLOTS.

Earlies.—*Edzell Blue*.

2nd Earlies.—*Great Scot*, *Ally* and *Mr. Bresse*.

Early Maincrops and Lates.—*Lochar*, *Templar*, *Tinwald Perfection*, *Dominion*, *Kerr's Pink*, *Shamrock*, *Majestic* and *Golden Wonder*.

With the exception of *Shamrock* and *Irish Queen*, which were obtained from Ireland, the "seed" planted was "Scotch."

SUMMARY OF RESULTS.

Large Trials.

	Birming- ham.	Buckley, Flint.	Cardiff	Arnold, Notts.	Hamsterley Colliery, Durham	Pwllheli, Carnarvon.
	lb.	lb.	lb.	lb.	lb.	lb.
<i>Edzell Blue</i> :						
Ware ..	145	97	320	258	102	175
Seed ..	45	50		36		50
Chats ..	20	16	18	10	43	22
Total ..	210	163	338	304	145	247

		Birming- ham.	Buckley, Flint.	Cardiff.	Arnold, Notts.	Hamsterley Colliery, Durham.	Pwllheli, Carnarvon.
<i>Witch Hill ;</i>							
Ware	..	50	74	270	119	61	150
Seed	..	25	18		49		53
Chats	..	14	9	16	14	26	18
Total	..	89	101	286	182	87	221
<i>King George ;</i>							
Ware	..	154	160	377	350	188	180
Seed	..	30	20		26		70
Chats	..	10	3	9	0	19	6
Total	..	194	183	386	385	207	256
<i>The Ally ;</i>							
Ware	..	147	170	439	385	136	210
Seed	..	34	18		29		45
Chats	..	14	6	9	6	15	13
Total	..	195	194	448	420	151	268
<i>Mr. Bresse ;</i>							
Ware	..	140	116	276	126	73	150
Seed	..	27	11		36		25
Chats	..	7	2	12	12	12	16
Total	..	174	129	288	174	85	191
<i>Culdees Castle ;</i>							
Ware	..	137	95	232	260	121	140
Seed	..	41	28		38		42
Chats	..	18	18	12	19	24	11
Total	..	196	141	244	317	145	193
<i>The Provost ;</i>							
Ware	..	128	105	273	351	135	154
Seed	..	38	21		29		31
Chats	..	15	16	7	11	24	4
Total	..	181	142	280	391	159	189
<i>Rob Roy ;</i>							
Ware	..	173	125	350	424	198	125
Seed	..	45	21		22		25
Chats	..	22	10	10	9	20	7
Total	..	240	156	360	455	218	157
<i>Lochar ;</i>							
Ware	..	177	173	380	458	217	131
Seed	..	45	12		21		51
Chats	..	26	12	9	8	27	5
Total	..	248	197	389	487	244	187

		Birming- ham.	Buckley, Flint.	Cardiff .	Arnold, Notts.	Hamsterley Colliery, Durham.	Pwllheli, Carnarvon.
<i>Templar ;</i>							
Ware ..	102	128	{ 303	276	{ 197	132	
Seed ..	37	23		51		46	
Chats ..	28	4	19	15	14	9	
Total ..	167	155	322	343	211	187	
<i>Dominion ;</i>							
Ware ..	143	161	{ 287	338	{ 192	108	
Seed ..	36	9		39		42	
Chats ..	14	2	6	13	30	12	
Total ..	193	172	293	390	222	162	
<i>Tinwald Perfection ;</i>							
Ware ..	147	120	{ 316	356	{ 186	128	
Seed ..	32	14		24		49	
Chats ..	18	5	10	12	19	7	
Total ..	197	139	326	392	205	184	
<i>Kerr's Pink ;</i>							
Ware ..	187	186	{ 334	414	{ 229	110	
Seed ..	44	21		34		50	
Chats ..	16	6	10	10	44	16	
Total ..	247	213	344	458	273	176	
<i>Rector ;</i>							
Ware ..	116	117	{ 209	206	{ 155	85	
Seed ..	32	15		37		40	
Chats ..	12	3	15	13	19	5	
Total ..	160	135	224	346	174	130	
<i>Irish Queen .</i>							
Ware ..	104	120	{ 185	265	{ 162	121	
Seed ..	23	5		44		28	
Chats ..	18	2	7	14	16	4	
Total ..	145	127	192	323	178	153	
<i>Shamrock ;</i>							
Ware ..	99	102	{ 226	148	{ 156	149	
Seed ..	44	21		48		51	
Chats ..	9	7	17	15	18	9	
Total ..	152	130	243	211	174	209	
<i>Langworthy ;</i>							
Ware ..	97	117	{ 210	339	{ 174	97	
Seed ..	27	6		38		38	
Chats ..	12	3	6	12	16	10	
Total ..	136	126	216	389	190	145	

	Birming- ham.	Buckley, Flint.	Cardiff.	Arnold, Notts.	Hamsterley Colliery, Durham.	Pwllheli, Carnarvon.
<i>Golden Wonder ;</i>						
Ware ..	113	112	219	303	168	150
Seed ..	23	19		43		49
Chats ..	9	4	6	13	15	5
Total ..	145	135	225	359	183	204
<i>White City ;</i>						
Ware ..	118	102	202	377	154	145
Seed ..	10	5		33		47
Chats ..	6	2	8	12	16	3
Total ..	140	109	210	422	170	195
<i>Majestic ;</i>						
Ware ..	150	177	477	437	138	180
Seed ..	36	21		19		45
Chats ..	7	7	6	4	14	10
Total ..	193	205	483	460	152	235
<i>Great Scot ;</i>						
Ware ..	201	142	359	372	228	136
Seed ..	40	47		36		64
Chats ..	17	9	3	7	17	13
Total ..	258	198	362	415	245	213

SMALL TRIALS.

W.—Ware. S.—Seed. C.—Chats. T.—Total.

	Edzell Blue.			Great Scot.			Ally.			Mr. Bresse.			Lochar.			Templar.								
	W.	S. C.	T.	W.	S. C.	T.	W.	S. C.	T.	W.	S. C.	T.	W.	S. C.	T.	W.	S. C.	T.						
	lb.			lb.			lb.			lb.			lb.			lb.								
Huddersfield	51	14	1	66	56	7	1	64	61	9	1	71	39	10	1	50	59	11	1	71	18	10	2	30
Stoke-on-Trent	70	—	2	70	100	—	—	100	100	—	—	100	53	—	—	53	95	—	—	95	112	—	—	112
Wolverhampton	45	—	2	47	54	—	4	58	52	—	3	55	27	—	3	30	39	—	9	48	38	—	5	43
Fairfield (Buxton)	64	—	—	64	74	—	—	74	94	—	—	94	—	—	—	—	63	—	—	63	55	—	—	55
North, S. Wales	60	—	20	100	85	—	10	95	80	—	8	88	42	—	4	46	76	—	6	82	75	—	5	80
Bishopstun, Glam.	67	—	1	68	53	—	5	58	84	—	1	85	56	—	1	57	74	—	2	76	83	—	1	84
Stockport ..	95	6	1	102	131	8	2	141	163	7	2	172	89	4	2	95	86	10	3	99	50	7	4	67
Pontardawe	31	7	3	41	63	15	10	88	95	10	2	107	27	5	4	36	—	—	—	—	54	13	3	70
Walsall ..	108	22	3	138	156	26	10	192	149	18	4	171	97	26	4	127	144	42	11	197	116	20	3	148
Kidderminster	43	12	3	58	52	22	4	78	38	13	5	56	41	9	2	52	25	18	8	51	15	28	6	49
Mansfield ..	44	6	—	50	60	10	—	77	66	13	—	79	54	5	—	59	74	10	—	84	60	12	—	72
Abercynon, Glam...	115	33	12	160	184	40	3	227	130	26	—	156	100	18	—	118	160	22	9	191	93	52	3	148
St. Helens ..	46	21	2	69	75	15	2	92	80	9	2	91	27	7	5	39	59	9	5	73	42	9	5	56
Market Drayton	77	17	8	102	125	7	6	138	116	8	4	128	66	9	10	85	115	9	6	130	100	11	4	115
Sheffield ..	84	30	4	118	66	24	11	101	96	22	11	129	72	14	4	90	40	21	21	82	32	32	19	83
Blackburn ..	50	12	6	68	66	12	5	83	73	13	3	89	30	4	2	36	30	22	14	66	23	22	4	49
Stafford ..	93	14	6	113	117	21	7	145	77	20	3	100	59	7	1	67	87	16	7	110	73	12	6	91
Barton-on-Trent	96	4	1	101	114	4	4	122	106	4	4	114	58	4	3	65	85	4	4	93	74	4	4	82
Birkenhead ..	73	—	—	73	90	—	—	90	105	—	—	105	58	—	—	58	77	—	—	77	50	—	—	50
Carlisle ..	35	14	7	56	68	28	—	96	84	20	—	104	18	14	—	32	42	21	—	63	14	28	9	51
Nuneaton, Warwick	59	—	3	62	41	—	—	42	69	—	—	70	26	—	—	27	43	—	2	45	59	—	1	60
Hugglescote ..	56	20	1	77	96	17	1	114	100	11	1	118	56	14	1	71	90	20	2	112	61	19	2	82
Brigend, Glam.	36	10	10	56	52	10	10	72	33	12	8	53	35	20	16	71	50	25	10	85	20	30	14	64
Roundhay, Leeds¹..	23	12	15	50	44	10	2	56	60	10	8	78	15	7	7	28	42	17	4	63	21	17	4	42

SMALL TRIALS.

[illegible]

Comparison of Highest Weights in the Large Trials.

(Figures represent weights in lb.)

Four Varieties giving Heaviest Yields in each Trial.

Centre.	1st.	2nd.	3rd.	4th.
Birmingham ..	<i>Great Scot</i> (258).	<i>Lochar</i> (248).	<i>Kerr's Pink</i> (247).	<i>Rob Roy</i> (240).
Buckley	<i>Kerr's Pink</i> (213).	<i>Majestic</i> (205).	<i>Lochar</i> (198).	<i>Great Scot</i> (197).
Cardiff	<i>Majestic</i> (483).	<i>Ally</i> (448).	<i>Lochar</i> (389).	<i>Great Scot</i> (362).
Arnold, Notts. ..	<i>Lochar</i> (487).	<i>Majestic</i> (460).	<i>Kerr's Pink</i> (458).	<i>Rob Roy</i> (455).
Hamsterley, Durham	<i>Kerr's Pink</i> (273).	<i>Great Scot</i> (245).	<i>Lochar</i> (244).	<i>Dominion</i> (222).
Pwllheli	<i>Ally</i> (268).	<i>King George</i> (256).	<i>Edzell Blue</i> (247).	<i>Majestic</i> (235).

It is interesting to observe that the heaviest yield from any plot was *Lochar* with 487 lb. at Arnold. This variety has during the last three years given most unsatisfactory crops in many districts, yet it appears 5 times as one of the four heaviest-cropping varieties. *Lochar* is certainly a very reliable cropping variety provided Scotch "seed" is planted.

It should also be observed that *Rob Roy* appears twice in the above list. *Tinwald Perfection*, which is a synonym of *Rob Roy*, does not appear.

Comparison of Highest Weights in Small Trials.

(Figures represent Weights in lb.)

Three Varieties giving Heaviest Yields in each Trial.

Centre.	1st.	2nd.	3rd.
Huddersfield ..	<i>Majestic</i> (72).	<i>Lochar</i> (71).	<i>Ally</i> (71).
Stoke-on-Trent ..	<i>Kerr's Pink</i> (130).	<i>Templar</i> (112).	<i>Ally</i> (100).
Wolverhampton ..	<i>Majestic</i> (60).	<i>Great Scot</i> (58).	<i>Ally</i> (55).
Buxton	<i>Ally</i> (94).	<i>Majestic</i> (83).	<i>Great Scot</i> (74).
Neath	<i>Kerr's Pink</i> (103).	<i>Edzell Blue</i> (100).	<i>Great Scot</i> (95).
Bishopston	<i>Kerr's Pink</i> (90).	<i>Majestic</i> (88).	<i>Ally</i> (85).
Pontardawe	<i>Kerr's Pink</i> (110).	<i>Ally</i> (107).	<i>Great Scot</i> (95).
Walsall	<i>Kerr's Pink</i> (108).	<i>Lochar</i> (107).	<i>Majestic</i> (103).
Kidderminster ..	<i>Great Scot</i> (78).	<i>Kerr's Pink</i> (67).	<i>Edzell Blue</i> (58).
Mansfield	<i>Lochar</i> (84).	<i>Tinwald</i> <i>P'non</i> (84).	<i>Ally</i> (79).
Abercynon	<i>Great Scot</i> (227).	<i>Majestic</i> (216).	<i>Lochar</i> (191).
St. Helens	<i>Great Scot</i> (92).	<i>Ally</i> (91).	<i>Edzell Blue</i> (69).
Market Drayton ..	<i>Great Scot</i> (138).	<i>Lochar</i> (130).	<i>Ally</i> (128).
Sheffield	<i>Kerr's Pink</i> (153).	<i>Ally</i> (129).	<i>Edzell Blue</i> (118).
Blackburn	<i>Ally</i> (89).	<i>Great Scot</i> (83).	<i>Kerr's Pink</i> (72).
Stafford	<i>Great Scot</i> (145).	<i>Edzell Blue</i> (113).	<i>Kerr's Pink</i> (111).
Burton-on-Trent ..	<i>Great Scot</i> (122).	<i>Ally</i> (114).	<i>Majestic</i> (105).
Birkenhead	<i>Kerr's Pink</i> (109).	<i>Ally</i> (105).	<i>Great Scot</i> (90).
Carlisle	<i>Ally</i> (104).	<i>Great Scot</i> (96).	<i>Majestic</i> (68).
Nuneaton	<i>Ally</i> (70).	<i>Edzell Blue</i> (62).	<i>Templar</i> (60).
Hugglescote	<i>Ally</i> (118).	<i>Great Scot</i> (114).	<i>Lochar</i> (112).
Bridgend	<i>Majestic</i> (97).	<i>Lochar</i> (85).	<i>Kerr's Pink</i> (80).
Leeds	<i>Kerr's Pink</i> (94).	<i>Ally</i> (78).	<i>Lochar</i> (63).
Stockport	<i>Ally</i> (172).	<i>Majestic</i> (150).	<i>Great Scot</i> (141).

The varieties appear as follows:—Ally, 18 times; Great Scot, 15 times; Kerr's Pink, 12 times; Majestic, 10 times; Lochar 8 times; Edzell Blue, 6 times; Templar, twice; and Tinwald Perfection, once.

Comparison of Lowest Weights in the Large Trials.

(Figures represent Weights in lb.)

Four Varieties giving Lowest Yields in each Trial.

Centre.	1st.	2nd.	3rd.	4th.
Birmingham ..	Witch Hill (89).	Irish Queen (135).	Langworthy (136).	Mr. Bresse (140).
Buckley ..	Witch Hill (101).	White City (109).	Langworthy (126).	Mr. Bresse (127).
Cardiff ..	Irish Queen (192).	White City (210).	Langworthy (216).	Rector (214).
Arnold ..	Mr. Bresse (174).	Witch Hill (182).	Shamrock (211).	Edzell Blue (304).
Hamsterley ..	Mr. Bresse (85).	Witch Hill (87).	Edzell Blue (145).	Culdees (145).
Pwllheli ..	Rector (130).	Langworthy (145).	Irish Queen (153).	Dominion (162).

Witch Hill seedling being a first early will naturally give lighter crops than the second-early and late varieties which will account for it being present four times in the above list.

Shamrock was planted at the same time as the other varieties in these larger trials. It appears only once in the above list. but with a total weight of 211 lb.

Comparison of Lowest Weights in the Small Trials.

(Figures represent weights in lb.)

Three Varieties giving Lowest Yields in each Trial.

Centre.	1st.	2nd.	3rd.
Wolverhampton ..	Mr. Bresse (30).	Shamrock (31).	Dominion (37).
*Buxton ..	Golden Wonder (35).	T. Perfection (50).	Kerr's Pink (53).
Neath ..	Shamrock (34).	Mr. Bresse (46).	Majestic (72).
Bishopston ..	Dominion (55).	Mr. Bresse (57).	Great Scot (50)
Pontardawe ..	Mr. Bresse (36).	Edzell Blue (41).	T. Perfection (50)
Walsall ..	Shamrock (82).	Mr. Bresse (127).	Shamrock (50)
Kidderminster ..	Shamrock (40).	Golden Wonder (41).	Majestic (50)
Mansfield ..	Shamrock (38).	Edzell Blue (50).	Dominion (132).
Abercynon ..	Mr. Bresse (118).	Dominion (129).	T. Perfection (42).
St. Helens ..	Mr. Bresse (39).	Dominion (47).	Mr. Bresse (59).
Market Drayton ..	Golden Wonder (76).	T. Perfection (78).	Kerr's Pink (129).
Sheffield ..	Shamrock (55).	Majestic (56).	Golden Wonder (64).

* Shamrock missing.

(*Figures represent weights in lb.*)
Three Varieties giving Lowest Yields in each Trial,

<i>Centre.</i>	<i>1st.</i>	<i>2nd.</i>	<i>3rd.</i>
Blackburn	<i>Shamrock</i> (26).	<i>Golden Wonder</i> (29).	<i>Mr. Bresse</i> (36).
Stafford	<i>Majestic</i> (49).	<i>Golden Wonder</i> (60).	<i>Mr. Bresse</i> (67).
Burton-on-Trent ..	<i>Shamrock</i> (58).	<i>Mr. Bresse</i> (65).	<i>Golden Wonder</i> (68).
*Birkenhead	<i>Templar</i> (50).	<i>Mr. Bresse</i> (58).	<i>Golden Wonder</i> (70).
Carlisle	<i>Mr. Bresse</i> (32).	<i>Dominion</i> (42).	<i>Shamrock</i> (51).
Nuneaton	<i>Mr. Bresse</i> (27).	<i>T. Perfection</i> (41).	<i>Great Scot</i> (42).
*Hugglescote	<i>Mr. Bresse</i> (71).	<i>Edzell Blue</i> (77).	<i>Templar</i> (82).
*Bridgend	<i>Golden Wonder</i> (51).	<i>Ally</i> (53).	<i>Majestic</i> (56).
Stockport	<i>Shamrock</i> (56).	<i>Templar</i> (67).	<i>Golden Wonder</i> (87).
Leeds	<i>Mr. Bresse</i> (28).	<i>Shamrock</i> (28).	<i>T. Perfection</i> (28).
Huddersfield	<i>Shamrock</i> (27).	<i>Templar</i> (30).	<i>Golden Wonder</i> (46).

* Shamrock missing.

The varieties appear as follows:—*Mr. Bresse*, 17 times; *Shamrock*, 13 times; *Golden Wonder*, 12 times; *Dominion*, 7 times; *Tinwald Perfection*, 6 times; *Majestic*, 5 times; *Templar*, 4 times; *Edzell Blue*, 3 times; *Great Scot* and *Kerr's Pink*, twice; *Ally*, once.

Shamrock appears 13 times in the above list, but it should be noted that this variety was planted at a much later date, and, therefore, its low position is probably due to this fact.

Mr. Bresse has cropped badly in most of the trials, its quality is poor and it is subject to late blight. It is, therefore, a variety which cannot be recommended.

It is interesting to note also that in these lowest yields *Majestic* appears 5 times, and *Great Scot* and *Kerr's Pink* each twice.

Yields per Acre.—Owing to lack of space, it will not be possible to give the approximate yields per acre for each plot.

It is evident, however, that amongst the immune varieties there are potatoes that will yield very heavy crops, and some of them may be classed amongst the heaviest-cropping varieties in cultivation at the present time.

Late Blight.—The varieties on which the disease appears to have been most prevalent are *Edzell Blue* and *Mr. Bresse*. and to a much lesser degree *Great Scot* and *Abundance*. At one or two centres *White City*, *Culdees Castle* and *Provost* were badly attacked.

Cooking Quality.—For the information of local growers tests on the cooking qualities of the potatoes were carried out at

several centres. An interesting report was received from Miss Gorvin, who tested the different varieties grown at Cardiff.

The excellent quality of *Langworthy* and *Golden Wonder* is admitted, while *Kerr's Pink* and *Templar* rank high in Miss Gorvin's report.

WART DISEASE OF POTATOES ORDER, 1918, & INSPECTION OF IMMUNE CROPS.

The Wart Disease of Potatoes Order of 1918 prohibits the planting of varieties of potatoes susceptible to wart disease in districts that have been certified as "infected areas," and prescribes that, except where the sale is to a dealer in seed potatoes, immune varieties may be sold only by persons holding a licence from the Board. In consequence of these regulations the Board have felt it necessary to take steps to secure an adequate provision of seed of immune varieties at a reasonable price, and to ensure that occupiers in infected areas shall be supplied with seed reasonably free from "rogues."

Growth of Immune Varieties in Scotland under Contract.—Arrangements were made with certain contractors in Scotland to grow during 1918 the following immune varieties:—

First Early Variety:—Edzell Blue.

Second Early Varieties:—King George, Ally, Great Scot.

Maincrop Varieties:—Tinwald Perfection, Lochar, Kerr's Pink, Dominion, Majestic.

Arrangements were also made for the distribution of the "seed" from these crops for planting in infected areas in 1919. The crops were grown under the personal supervision of the Board's Inspectors and were carefully "rogued." The Inspectors also supervised the dressing out of the "seed" from the "ware."

The lack of an adequate supply of First Early varieties immune from wart disease presents a serious difficulty in the administration of the Order. To overcome this difficulty the Board have made arrangements with growers in Scotland by which it is anticipated that adequate supplies of First Early immune "seed" will be available for distribution in infected areas in 1921, at prices comparable with those obtaining for susceptible First Earlys in that season.

Inspection of Growing Crops.—The efficacy of the regulation enforcing the planting in infected areas of immune varieties depends entirely on the purity of the "seed" used. The presence of "rogues" is bound to perpetuate the risk of infection, and, moreover, to weaken the faith of growers in the value of immune varieties. The practicability of carrying out a scheme of inspection of crops during the growing stage (the only time at which the presence of plants not true to type can be detected with certainty) was carefully considered, after consultation with officers of the Board of Agriculture for Scotland and the Department of Agriculture and Technical Instruction for Ireland, who undertook to carry out similar schemes in their respective countries. The method of inspection and the minimum standard of purity on which a certificate should be issued were carefully considered and prescribed. Notices were then published in the press inviting growers of immune varieties in England and Wales to apply for the inspection of their crops. Some 600 applications were received as a result of this invitation and over 4,000 acres of potatoes were actually examined. It is a matter for satisfaction that only 350 acres ultimately fell below the standard prescribed for the issue of certificates.

In all cases where the Inspectors were satisfied with the crop a certificate was issued to the effect that the potatoes examined were, to the best of the Inspector's knowledge and belief, of the variety specified, true to type and reasonably free from "rogues." By the Seed Potatoes Order of 1918, issued by the Ministry of Food, it is obligatory for the vendor to quote the number of this certificate on the invoice in all sales of inspected "seed."

The possession of a certificate greatly facilitates the issue of licences to sell immune "seed" by retail. The inspections carried out by no means covered the whole of the acreage of immune varieties, and a number of applications have been received for licences to sell uninspected "seed." In such cases the licence is not refused, but considerable delay occurs as inquiries have to be made as to the source of the stocks, and, where possible, an examination of the tubers is made. This method enables the Board to stop the sale for seed of stocks that are badly mixed, but it is not regarded as satisfactory, and the Board contemplate the refusal next season of licences in respect of any stocks that have not been examined while growing.

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Articles or reports on the following subjects have appeared in the *Journal* each month or from time to time, and are not separately indexed :—Notes on Feeding Stuff, Notes on Manures, Notes on Crop Prospects and Live Stock Abroad, Notes on Agriculture Abroad, Notes on the Weather, Notes on Agricultural Labour in England and Wales, Notes on Agricultural Conditions in England and Wales, Prices of Agricultural Produce, Outbreaks under the Diseases of Animals Acts, Lists of Additions to the Ministry's Library, and Selected Contents of Periodicals.

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